

Doctoral Researchers (f/m/d) in Molecular Communications at the Institute for Digital Communications

Overview on the Research Area: While conventional communication systems rely on electromagnetic waves, in **Molecular Communication (MC)**, information is encoded into the properties of molecules. This allows communication between nodes with sizes in the order of nano- and micrometers and in environments where electromagnetic signaling is impractical or impossible.

The envisioned applications of MC are very diverse. In **healthcare**, MC facilitates the **Internet of BioNanoThings** – a network of sensors and actuators operating inside the human body to detect biomarkers and deliver localized, personalized treatment – and provides a communication-theoretic framework for drug delivery, health monitoring, and natural signaling pathways such as the gut-brain axis. In **industrial applications**, molecular signals carry information through pipelines, confined spaces, and metallic structures. Hereby MC enables new concepts for industrial monitoring and process design. In **environmental monitoring**, MC enables the distributed sensing of pollutants and leaks, and helps to understand and design chemical communication systems among plants, bacteria, and insects.

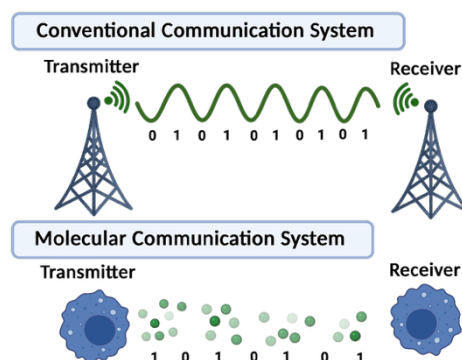


Figure 1: **Top:** Conventional communication system, where information is encoded into EM-waves. **Bottom:** MC system, where information is encoded into molecules.

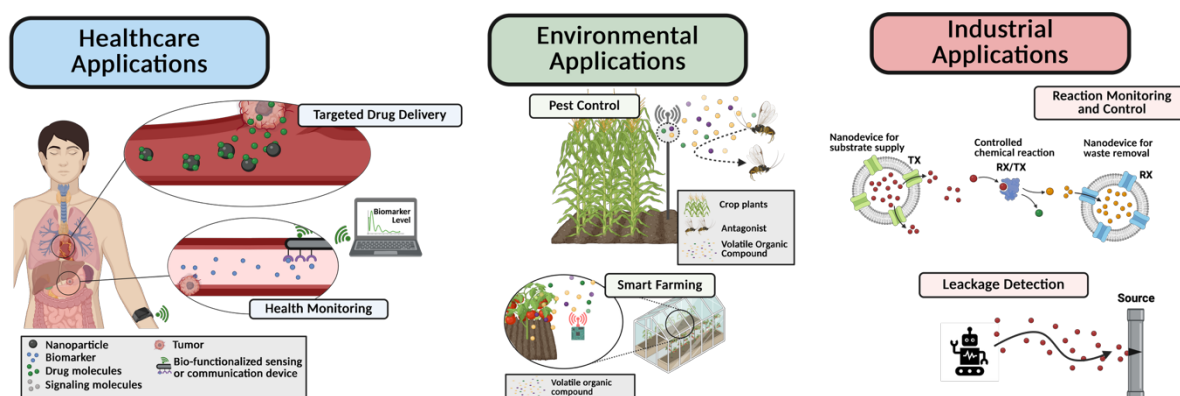


Figure 2: Envisioned applications of MC

Research Directions: We have several openings for PhD positions covering topics including:

- **Modeling and optimization of drug delivery systems**, including the theoretical and experimental design of suitable hardware (drug carriers, nanoparticles) and the optimization of the end-to-end drug delivery system from a communication theoretical perspective.
- **Modeling of the Cardiovascular system as a communication channel** for future healthcare applications such as targeted treatment and health monitoring and for the efficient communication between in-body devices.
- **Therapeutic modulation of the gut-brain axis and other natural signaling pathways** based on information- and communication-theoretic tools.
- **Design and Analysis of airborne MC systems**, where information is encoded into mixtures of molecules inspired by natural odor communication between humans, plants and insects.
- **Design and realization of experimental MC testbeds** in close interdisciplinary collaborations with researchers from chemistry, biology and medicine.

Your research may involve statistical modeling, information and communication theory, detection and estimation, numerical simulation, optimization, machine learning, and hands-on experimental and hardware work. All research projects are closely aligned with experimental research in collaboration with projects partners from various research

disciplines including chemistry and medicine. During the project, there will also be opportunities to visit project partners in other countries for research stays.

Qualification Profile: Master Degree in Electrical Engineering, Physics, Computational Biology or a related field. Strong interest in interdisciplinary research.

We offer

- TV-L E13 position
- High quality interdisciplinary research in a dynamic and fascinating field of research
- A structured supervision and qualification program

Application via e-mail

Please submit a **single pdf file**, including a **motivation letter** (max. 1 page), **curriculum vitae** (max. 2 pages), and **copies of graduation certificates** and **transcript of records** to idc-jobs@fau.de. Applications are being received until the positions are filled.

For further information contact Prof. Robert Schober (robert.schober@fau.de), Dr. Maximilian Schäfer (max.schaefer@fau.de), Dr. Sebastian Lotter (sebastian.g.lotter@fau.de)