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## **Molecular Insights into Cellular Communication in Health and Disease**

### **Abstract**

Cells constantly exchange information with their environment and with each other. These molecular conversations occur across all domains of life, whether human, animal, plant, or microbial, and are mediated by chemical, physical, and biological signals that regulate cooperation, defense, and competition.

Importantly, cellular signals are not simple on/off switches. Instead, they are highly dynamic and can be modified by surrounding cells, thereby altering their molecular meaning and biological impact. To process this complexity, cells rely on sophisticated molecular machines that act as sensors, processors, and transport systems. These machineries detect, relay, and integrate signals, allowing cells to interpret multiple inputs simultaneously and respond appropriately to their physiological context. Together, signalling molecules and the molecular systems that recognize and transmit them form intricate communication networks that underpin cellular function and health.

Our research aims to uncover the molecular principles governing such communication networks from microbes to man. By integrating microbiology, biochemistry, structural biology, and biophysics, we investigate how membrane-associated protein machineries detect and process chemical signals and how their dysregulation contributes to disease. Understanding these mechanisms enables us to "listen in" on cellular communication processes and provides new perspectives on antimicrobial resistance, host–microbe interactions, and molecular signal integration in complex biological systems.

### **CV**

Prof. Dr. Ute A. Hellmich is Full Professor of Biostructural Interactions at Friedrich Schiller University Jena and affiliated with the Cluster of Excellence Balance of the Microverse. Her research focuses on the molecular mechanisms of membrane-associated transport and signaling systems, particularly in the context of antibiotic resistance, cellular signal integration, and redox metabolism in pathogenic microorganisms.

She studied biochemistry at Goethe University Frankfurt, where she also obtained her PhD in biophysical chemistry. After a postdoctoral research stay at Harvard University, she became a Junior Professor for Membrane Biochemistry in Mainz. In 2021, she was appointed W3 Professor at Friedrich Schiller University Jena. Her work has been recognized by multiple awards, including the Fulbright-Cottrell Award, the Dozentenpreis des Fonds der chemischen Industrie and an Exploration Grant from the Boehringer Ingelheim Foundation and was named Fellow of the Max Planck Society in 2025.

Prof. Hellmich has organized many national and international meetings, including the FEBS ABC Conference and serves as the incoming Chair of the Gordon Research Conference on Ligand Recognition and Molecular Gating. She is actively engaged in mentoring early-career researchers and contributes to several mentoring initiatives, including the Leibniz Society Mentoring Programme, the Ada Lovelace Mentoring Programme or the UNIBUND mentoring programme (Jena-Leipzig-Halle) for female postdoctoral researchers and the Studienstiftung des deutschen Volkes for undergraduates.