

Research Topics

In their natural habitat, microorganisms do not occur in isolation but live in close association with other organisms of different species and developmental stages. Their interactions can take many forms, ranging from mutual symbiosis to parasitic interactions. How these complex, multi-organismic networks are regulated by microbial communication is still poorly understood. Gaining insight into the **microbial and biomolecular interactions** underlying the communication processes among microorganisms in diverse habitats is the main research focus of the ILRS Jena. The ILRS PhD projects try to answer these intriguing questions with interdisciplinary approaches, combining methods of microbiology, natural product chemistry, chemical ecology, bioinformatics and systems biology. The ILRS Faculty is composed of professors and group leaders of different disciplines from all participating institutions. ILRS Jena is embedded in the outstanding microbiological research community in Jena and part of a highly interactive network of scientific discourse and experimental work.

The ILRS research projects focus on

- interactions between microorganisms
- host/microbial pathogen interactions
- role of networks and bioinformatics.

Interactions between microorganisms

Microorganisms are able to synthesize a multitude of natural products that act as mediators of communication between organisms of the same or different species. These low molecular weight compounds can act as attractants, e.g. in the pheromone signaling pathways in fungi, or as repellents for competitors for limited nutritional resources. Many of the antibiotics known today are (or are derived from) such molecules. Research within the ILRS aims at better understanding the signaling pathways involved in natural product synthesis and at unraveling the complex interactions between microorganisms at the genetic and molecular level.

Host/microbial pathogen interactions

The human body is host to billions of bacteria and fungi of different species. Most of them are harmless or even beneficial, but some microorganisms can cause severe diseases. ILRS projects address the questions why this is the case, which signaling pathways are involved in the infection process, and how the host immune system reacts to the infection. But research is not limited to human / microbe interactions – also plant - microbe interactions and viral infection of phytoplankton are studied as model systems for complex multi-organismic networks.

Role of networks, interactions and their analysis

In recent years, the information available about the genomes and transcriptomes of a wide variety of microorganisms as well as their host organisms has rapidly increased. Researchers within the ILRS make use of these data, together with experimentally obtained results, to analyse intra- and intercellular microbial communication. Bioinformatic tools are employed to model the intricate regulatory networks involved in signaling processes and in organism development.