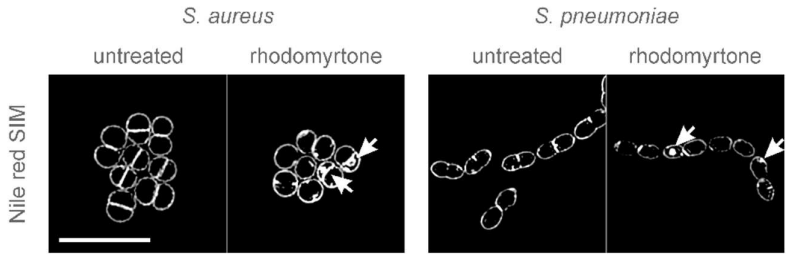
Novel strategies to combat drug-resistant bacteria

Background

The discovery of antibiotics such as penicillin revolutionized modern medicine. Formerly deadly diseases became easily treatable and infections following childbirth or surgical procedures could be effectively medicated. However, this privileged situation could change drastically over the next years. Bacteria possess a remarkable capability to genetically adapt and become increasingly resistant to existing antibiotics. Only few new antibiotics have been developed in the last decades, which makes it increasingly difficult to keep up with the development of bacterial resistance. To reverse this trend and prevent a fallback into a pre-antibiotic era, we need to advance antibiotic discovery and minimize the development and spread of antibiotic resistance. In order to achieve this, it is essential to understand the molecular mechanisms underlying the activity of antibiotics and the countermeasures that bacterial cells employ to acquire tolerance or resistance to antibiotic drugs.

Project goals and methods

In my group, we are particularly interested in the bacterial cell envelope, which is not only the barrier that antibiotics need to cross to reach intracellular targets but also an important antibiotic target structure by itself as well as the location of many important stress response systems. We are investigating the role of the bacterial cell envelope as both antibiotic target and location of bacterial countermeasures against antibiotic stress. Master projects in our group focus either on novel antibiotic candidates and strategies, or on characterizing bacterial resistance factors. Students will approach these projects using **advanced cell biological methods, different live cell imaging techniques, fluorescence spectroscopy, genetic, and biochemical methods.** Depending on the individual project, *in vitro* lipid and protein assays and -omics approaches might be employed as well.



Example of our work on novel drug candidates: High resolution microscopy of Staphylococcus aureus (left) and Streptococcus pneumoniae (right). A Nile red fluorescence stain reveals cell membrane damage caused by the new antibiotic rhodomyrtone. From: Saeloh et al., Plos Pathogens, 2018.

Available Projects

Projects are suitable for 6- or 12-month Master theses (30/60 credits). Starting dates are negotiable. Currently, projects in the following areas are available:

- Effects of antibiotics on the bacterial cell envelope
- Mechanisms of action of new antibiotic candidates
- Function of membrane-associated stress response proteins in antibiotic resistance
- Proteins as biosensors for membrane properties

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