

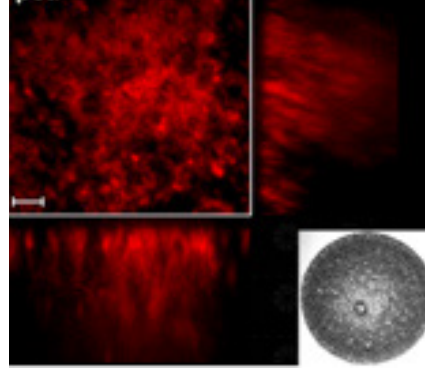


## FOCUS ON RESEARCH

Prof. Dr. Kai Papenfort

A5 / Area A Synthetic Cells and Switches

## Regulatory RNAs and interspecies communication of bacterial pathogens



Biofilm formation and collective behaviors of *Vibrio cholerae* are regulated by the *VqmR* sRNA.

*VqmR* is a newly identified, QS-dependent sRNA of *V. cholerae* controlling toxin production and biofilm formation in this major human pathogen.

Above: Biofilm formation in wild-type cells. Below: Biofilm formation of *VqmR* over-producing cells. Scale: 5µm.

Inlays: colony morphology of the same strains.

RNA is common to all living organisms. Despite its major function as the coding agent for protein synthesis, an increasing number of regulatory roles have been assigned to RNA in prokaryotic and eukaryotic organisms. RNA-based expression control can affect all layers of gene regulation, including transcription initiation, translation control and protein activity.

The most common group of regulatory RNAs in bacteria are the so-called small RNAs (sRNAs), which are now known to play important roles in the physiology of many species. In the major human pathogen *V. cholerae*, RNA-based gene circuits are intimately linked to interspecies communication, a process often referred to as Quorum Sensing (QS). QS involves the production, release, and detection of extracellular signal molecules called autoinducers, and allows bacteria to collectively regulate gene expression in response to changes in cell density and the species composition of the vicinal community. Processes controlled by QS, such as bioluminescence, secretion of virulence factors, and biofilm formation, are unproductive when undertaken by an individual bacterium but become effective when undertaken by the group. Understanding QS is fundamental to all of microbiology, and ultimately could prove to be key to understanding other collective behaviors, including those of higher organisms.

In my group, we study the molecular mechanism and biological roles of regulatory RNAs in the model pathogen *V. cholerae* and examine their impact on the processes of interspecies communication, i.e. QS.

## NEW MEMBERS

## PIs



We welcome **Chase Broedersz** (Theoretical Statistical & Biological Physics) and **Kai Papenfort** (Microbiology) as new PIs of the GRK2062.

Chase Broedersz started in September 2015 as W2 professor at LMU Munich. Within the GRK2062 research project A4 "Physical principles of DNA organization by interacting Nucleoid-Associated Proteins" his research group develops theoretical and computational frameworks to study the basic design principles of how nucleoid associated proteins localize on specific regions of the DNA, organize the bacterial chromosome in 3D, and can control DNA functions such as gene activity.

Kai Papenfort started in February 2015 as W2 professor at LMU Munich. For details about his project, please refer to "Focus on Research".

## PhD-students



**Fridtjof Brauns**, M.Sc. Theoretical and Mathematical Physics, is supervised by Erwin Frey since November 2015. Working title of his PhD thesis: "Mechanisms in mass conserving reaction diffusion systems".

**Ralph Krafczyk**, M.Sc. Biology, started his PhD study in October 2015. Supervised by Kirsten Jung and Jürgen Lassak he is focusing on "Modulation of the rhamnosyltransferase EarP for post-translational modification of diverse peptides".

**Marietta Landgraf**, M.Sc. Molecular Biotechnology, started her PhD study in May 2015 under the supervision of Arne Skerra. Working title of her PhD thesis is "Functionalization of an Anticalin scaffold with non-natural amino acids to target specific sugar structures of tumor cells".



**Patrick Wilke**, M.Sc. Theoretical and Mathematical Physics, is supervised by Erwin Frey since October 2015. He is working on his PhD thesis within the GRK research project "Design principles and control of synthetic cell polarity systems".



**Svetlana Wunder**, M.Sc. Chemistry, started her PhD study in July 2015. Supervised by Anja Hoffmann-Röder she is working on "Syntheses of flagellin glycopeptides from *Campylobacter jejuni*".

## FAREWELLS

**Thorsten Mascher** has accepted the call for the Chair and W3-professorship in Microbiology at the TU Dresden. Together with our former members, Jara Radeck (PhD-student) and Daniela Pinto (PostDoc), his lab moved to Dresden in September 2015. Of course, we'll keep in touch! [Research Group](#)

## EVENTS

## Retreat 2016

We are looking forward to our first Retreat which will take place in the [Benedictine abbey of Frauenwörth](#) on the Fraueninsel (The Women's Island) in Lake Chiemsee. The Retreat is scheduled for three days from April 7th (afternoon) to April 9th (afternoon) 2016.

## Program

Doctoral researchers, postdoctoral fellows, and invited guests will give talks. Newly started doctoral researchers present posters on their research. Our new PIs Chase Broedersz and Kai Papenfort will give talks about their research. Sheref Mansy (University of Trento) has accepted our invitation and will give insights in his exciting [Synthetic Biology projects](#). Nina Köhler (Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit) will give an overview about the duties of the Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit with special focus on Synthetic Biology. Additionally, the artist Pinar Yoldas will give a presentation about "An Ecosystem of Excess (the new plastozän)". Of course we will also spend time to make a boat trip to the island Herreninsel and visit the great Royal Palace of Herrenchiemsee.

## Upcoming Transferable Skills Courses

For women only: **Spiele mit der Macht**, [Marion Knaths](#)  
The course will run on the 1st of March 2016 from 9:30 to 17:30, in room G00.031 (Biocenter, LMU). For a full description please click [here](#). Please note: the course is held in German, but contributions in English are welcome.

Scientific Writing, [Science Craft](#)

This course will run on the 26th and 27th of July 2016 at LMU Biocenter. For a full description please click [here](#).

## Upcoming Methods Workshop

Workshop on Theoretical Physics e.g. **Chemical reaction kinetics of well-mixed systems**  
Participation in QBM lectures given by [Chase Broedersz](#) and [Ulrich Gerland](#) is possible (from January 11 to February 8, 2016). Please be aware that for understanding mathematical knowledge is required. For details of the schedule and registration please contact [grk2062@bio.lmu.de](mailto:grk2062@bio.lmu.de)

Group Photo:  
CAS-Conference  
Synthetic Biology II,  
27-29 July 2015



## JOURNAL CLUB

Science 14 August 2015: Vol. 349 no. 6249 p. 677

In Depth: Synthetic Biology  
[Modified yeast produce opiates from sugar](#)

[Robert F. Service](#)

## Summary

Synthetic biologists have engineered a strain of yeast to produce thebaine, an opiate closely related to morphine normally harvested from opium poppy plants. To do so, they engineered the microbes to express a medley of 21 genes, some from yeast themselves, as well as others from plants, bacteria, and even a rodent. By adding two additional genes, the engineers also coaxed yeast to make hydrocodone, one of the most commonly used painkillers on the market. The work may eventually help chemists come up with new painkillers and other medicines with fewer side effects, such as a lower propensity for addiction.

Outsiders say the work is a landmark for the increasing sophistication of synthetic biology's ability to engineer complex metabolic pathways into microbes. But biopolicy experts worry that if drug-makers get their hands on opiate-making microbes, it could eventually enable them to brew heroin with ease.

Full text: <http://dx.doi.org/10.1126/science.349.6249.677>