



Universität  
Basel

## Research Project

### cdBMP - Time, space and speed: cdGMP signaling in cell behaviour and reproduction

#### Third-party funded project

**Project title** cdBMP - Time, space and speed: cdGMP signaling in cell behaviour and reproduction

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#### **Organisation / Research unit**

Departement Biozentrum / Growth & Development

Departement Biozentrum / Infection Biology

Departement Biozentrum / Molecular Microbiology (Jenal)

#### **Department**

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#### **cdBMP- Time, space and speed: cdGMP signaling in cell behaviour and reproduction**

Bacterial biofilms are the primary cause of chronic infections and of resulting infection relapses. To be able to interfere with bacterial persistence it is vital to understand the molecular details of biofilm formation and to define how motile planktonic cells transit into surface-grown communities. The nucleotide second messenger cyclic di-guanosinemonophosphate (cdGMP) has emerged as a central regulatory factor governing bacterial surface adaptation and biofilm formation. Although cdGMP signaling may well represent the Achilles heel of bacterial communities, cdGMP networks in bacterial pathogens are exquisitely complex and an integrated cellular system to uncover the details of cdGMP dynamics is missing.

To quantitatively describe cdGMP signaling we propose to exploit *Caulobacter crescentus*, an organism with a simple bimodal life-style that integrates the sessile-motile switch into its asymmetric division cycle. We aim to: 1) identify the role and regulation of all diguanylate cyclases and phosphodiesterases that contribute to the asymmetric cellular program with the goal to model the temporal and spatial distribution of cdGMP during development; 2) identify and characterize cdGMP effectors, their downstream targets and cellular pathways; 3) elucidate how cdGMP coordinates cell differentiation with cell growth and propagation; 4) unravel the role of cdGMP as an allosteric regulator in mechanosensation and in rapid adaptation of bacteria to growth on surfaces; 5) develop novel tools to quantitatively describe cdGMP network dynamics, as the basis for mathematical modeling that provides the predictive power to experimentally test and refine important network parameters. We propose a multidisciplinary research program at the forefront of bacterial signal transduction that will provide the molecular and conceptual framework for a rapidly growing research field of second messenger signaling in pathogenic bacteria.

#### **Financed by**

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| ID      | Kreditinhaber | Kooperationspartner      | Institution                                 | Laufzeit -<br>von | Laufzeit -<br>bis |
|---------|---------------|--------------------------|---------------------------------------------|-------------------|-------------------|
| 2291812 | Jenal, Urs    | Schirmer, Tilman         | Biozentrum - University of<br>basel         | 01.05.2013        | 30.04.2018        |
| 2291815 | Jenal, Urs    | Howard, Martin, Prof.    | John Innes Centre, Norwich                  | 01.05.2013        | 30.04.2018        |
| 2291819 | Jenal, Urs    | Grzesiek, Stephan, Prof. | Biozentrum - University of<br>Basel         | 01.05.2013        | 30.04.2018        |
| 2291821 | Jenal, Urs    | Zavolan, Michaela, Prof. | Biozentrum - University of<br>Basel         | 01.05.2013        | 30.04.2018        |
| 2291822 | Jenal, Urs    | Vogel, Jörg, Prof.       | University of Würzburg                      | 01.05.2013        | 30.04.2018        |
| 404904  | Jenal, Urs    | Pfohl, Thomas, Professor | Physical Chemistry Univer-<br>sity of Basel | 01.01.2014        | 31.12.2017        |
| 2291844 | Jenal, Urs    | Roth, Volker, Prof.      | Biozentrum - University of<br>Basel         | 01.01.2010        | 31.12.2016        |
| 2291847 | Jenal, Urs    | Kaever, Volkhart, Prof.  | Medizinische Hochschule<br>Hannover         | 01.05.2013        | 30.04.2018        |