LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN GRK2062

WHAT'S GOING ON

in the Research Training Group Molecular Principles of Synthetic Biology

NEWSLETTER #2 2017

FOCUS ON RESEARCH

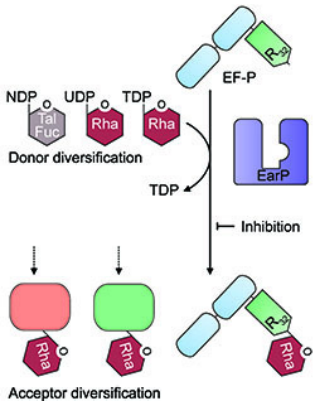


Figure 1. *EarP mediated glycosylation*
Right: *In about 10% of all bacteria the polyproline specific translation elongation factor EF-P is post-translationally activated by alpha-glycosylation of a strictly conserved arginine (R32). The glycosylation reaction is catalyzed by the EF-P-arginine rhamnosyltransferase EarP using dTDP-β-L-rhamnose (TDP-Rha) as a substrate.*
Left: *Activation of EF-P by non-cognate nucleotide sugar substrate (UDP-Rha: UDP-β-L-rhamnose; TDP-Tal: TDP β-L-Deoxytalose; TDP-Fuc: TDP-β-L-fucose) and glycosylation of non-cognate protein acceptors by EarP.*

Dr. Jürgen Lassak

B2 / Area B Synthetic Proteins

The sweet sites of bacteria

Glycosylation is one of the most important posttranslational modifications of proteins in biological systems and is associated with numerous biological processes including viral and bacterial infection, cancer metastasis, inflammatory response, innate and adaptive immunity. For a long time, protein glycosylation was believed to be restricted to eukaryotes. Today it is well accepted that also bacteria including important human pathogens possess O- and N-linked glycoproteins.

Until 2013, N-linked glycosylation was almost exclusively associated with asparagine. Two recently discovered (phylogenetically unrelated enzymes) NleB and EarP challenge this dogma as both proteins were shown to glycosylate the relatively inert guanidine group of arginine. However, to date almost nothing is known how NleB or EarP catalyze the glycosyl transfer reaction.

In our lab we are working on EarP from *Pseudomonas putida* and are currently investigating the structural basis for arginine glycosylation of the polyproline specific translation elongation factor EF-P. As EarP is essential for pathogenicity in *P. aeruginosa* and *Neisseria meningitidis* our study paves the way for targeted inhibitor design. Thus, together with the group of Prof. Anja Hoffmann-Röder we investigate the inhibitory potential of nucleotide sugar analogs. Moreover, we aim to tailor EarP substrate specificity so that the enzyme becomes a suitable tool for site-specific posttranslational modification of diverse proteins.

GRK2062 PUBLICATION

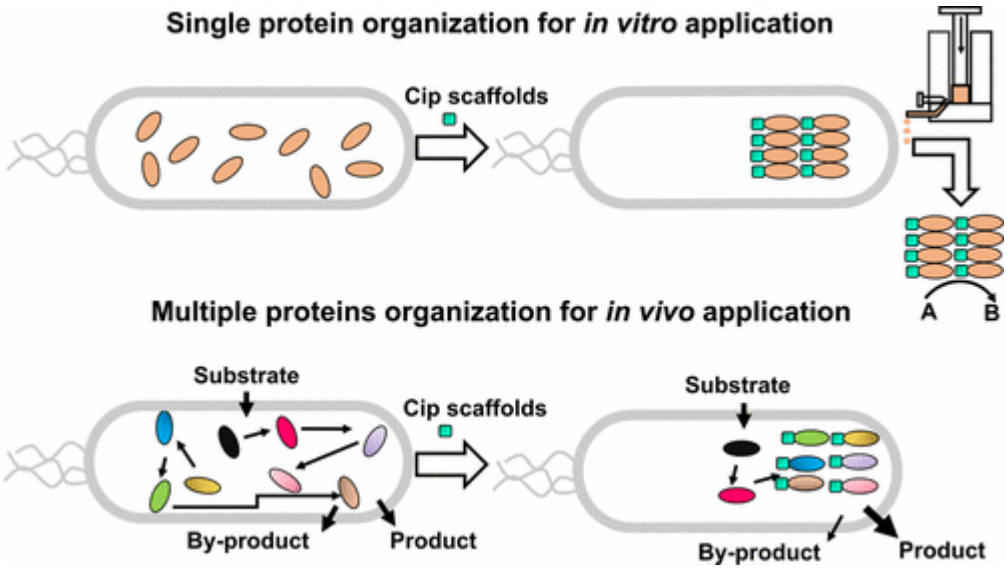
ACS Synthetic Biology, February 10th 2017

CipA and CipB as Scaffolds To Organize Proteins into Crystalline Inclusions

Research group Kirsten Jung

Abstract

Natural and synthetic scaffolds support enzyme organization in complexes, and they regulate their function and activity. Here we report that CipA and CipB, two small proteins that form protein crystalline inclusions (PCIs) in the cytoplasm of *Photorhabdus luminescens*, can be utilized as scaffolds to efficiently incorporate exogenous proteins into PCIs. We demonstrate that Cip-tagged GFP is assembled into fluorescent PCIs in *P. luminescens* and that in *Escherichia coli* Cip scaffolds can organize GFP or/and LacZ into bioactive PCIs, which could easily be isolated for *in vitro* catalysis. To explore its *in vivo* application further, we used CipA to bring together multiple enzymes (Vio enzymes) of the violacein biosynthetic pathway. The resulting complexes were found to produce significantly higher yields of violacein and fewer byproducts than did Vio enzymes in solution. Hence, Cip scaffolds should be widely applicable to biotechnological processes both *in vitro* and *in vivo*.



Full text: http://dx.doi.org/10.1021/acssynbio.6b00323

NEW MEMBERS

PhD-students

Carina Andrea Sommer, Dipl. Ing., started her PhD study in December 2016. Supervised by Arne Skerra she is focusing on “Functionalization of an Anticalin scaffold with non-canonical amino acids to target specific sugar structures on tumor cells“.

Daniel Devlitsarov, M.Sc. finished his master studies at university of Groningen in the Netherlands. He joined the Papenfort lab in March 2017 for his PhD study on RNA biology of *Vibrio cholerae*.

EVENTS

Joint Retreat 2017 - ICMSE Pre-conference and ICMSE main conference

Date: August 26-27, 2017 and August 27-29, 2017
Location: Uni Basel, Switzerland
Registration is open now, every junior researcher already received an e-mail with information about the registration process for both conferences. As every GRK2062 participant has to present his/her poster at both conferences, please submit your abstracts by end of April using the link from your registration confirmation (need to be done separately for each conference).
Please note: For the Pre-conference, four GRK2062 junior researchers will be elected to present a talk. GRK2062 Junior Researchers Committee and Kirsten Jung will care for this.
Accommodation in Hotel Spalentor is already booked for all junior researchers (about 4 min to walk to the conference location). There will be a **bus transfer** from Munich to Basel on August 25, 2017 in the early afternoon and back to Munich in the evening of August 29, 2017.

GRK2062 General Meeting 2017

During the upcoming summer term there will be our GRK2062 general meeting. Date will be announced as soon as possible.

Good Manufacturing Practice (GMP) course

A GMP course will run in Martinsried in October 2017

(details). GMP-Knowledge is often a key requirement in employment vacancies, especially in the pharmaceutical industry. For this reason, a course for students and graduates in the areas of pharmacy, biochemistry, biology and adjacent sciences is offered.
For registration please send an e-mail to grk2062@bio.lmu.de by April 24, 2017. In return, you will receive voucher codes for your registration.

JOURNAL CLUB

Nature Communications Jan 17 2017: Vol. 8, 14030

Article

Electronic control of gene expression and cell behaviour in *Escherichia coli* through redox signalling

Tanya Tschirhart, Eunkyoung Kim, Ryan McKay, Hana Ueda, Hsuan-Chen Wu, Alex Eli Pottash, Amin Zargar, Alejandro Negrete, Joseph Shiloach, Gregory F. Payne & William E. Bentley

Abstract
The ability to interconvert information between electronic and ionic modalities has transformed our ability to record and actuate biological function. Synthetic biology offers the potential to expand communication 'bandwidth' by using biomolecules and providing electrochemical access to redox-based cell signals and behaviours. While engineered cells have transmitted molecular information to electronic devices, the potential for bidirectional communication stands largely untapped. Here we present a simple electrogenetic device that uses redox biomolecules to carry electronic information to engineered bacterial cells in order to control transcription from a simple synthetic gene circuit. Electronic actuation of the native transcriptional regulator SoxR and transcription from the PsoxS promoter allows cell response that is quick, reversible and dependent on the amplitude and frequency of the imposed electronic signals. Further, induction of bacterial motility and population based cell-to-cell communication demonstrates the versatility of our approach and potential to drive intricate biological behaviours.

Full text: http://dx.doi.org/10.1038/ncomms14030

MISCELLANEOUS

Impression from the LSGN meeting in February 2017

Life Science Graduate Network - LSGN

Many people attended the LSGN get-together event held on the 23rd February at the LMU biocenter. Posters from people involved in different graduate programs in Munich were presented, and networking with food and music took place till 22pm! From the GRK2062, Philipp Glock and Dr. Michael Heymann presented posters on their exciting research, and had nice discussions about their projects together with the possibility to learn what other students in the campus are working on. **Next event is scheduled for the summer, stay tuned!**

The LSGN (=Life Science Graduate Network) is a network which was started by the PhD student reps of the different Life Science graduate schools and graduate programs in Munich (currently there are 16 schools and/or programs). The idea is to organise regular events for PhD students to promote exchange and share relevant topics. If you are interested in getting involved in the organization of LSGN or you want to share ideas on what could be organized next, don't hesitate to contact chiara.gandini@bio.lmu.de.

GRK2062
MOLECULAR PRINCIPLES OF SYNTHETIC BIOLOGY

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LMU

TUM TECHNISCHE UNIVERSITÄT MÜNCHEN

max planck institute of biochemistry

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