

Newsletter

Spatiotemporal dynamics of bacterial cells

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Science Report

A new regulatory mechanism in biology utilizes an alternative energy source

Evidence of CTP-dependent regulation of prokaryotic DNA segregation

Nucleotide-dependent regulation governs a variety of central biological processes, ranging from cell division and translation to signaling and motility. In many cases, it is mediated by nucleotide hydrolytic enzymes that act as molecular switches by alternating between an NDP-bound or nucleotide-free inactive form and an NTP-bound, active conformation. Whereas all previously known molecular switches use ATP or GTP, a collaboration between the Thanbichler and Bange labs has recently led to the discovery of a new molecular switch that utilizes CTP to control the accurate transmission of genetic information during cell division in bacteria.

The study, recently published in the journal *Cell*, shows that ParB, a key component of the bacterial DNA segregation machinery, binds and hydrolyses cytidine triphosphate (CTP). This unprecedented enzymatic activity had remained unnoticed for more than three decades since the discovery of ParB proteins and represents a major advance in the field, opening new perspectives in the study of prokaryotic DNA partition.

The authors demonstrated that CTP-binding and hydrolysis are essential for ParB function. The distinctive catalytic site, which is conserved in the widely distributed family of ParB/Srx domain-containing proteins, could represent a novel target for the development of

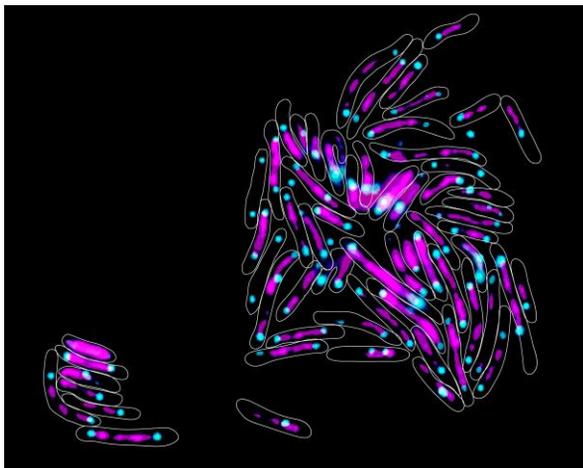
antibiotics. It will be also interesting to investigate whether a similar CTP-dependent regulatory mechanism could control the activity of other protein families and thus be a more general regulatory principle in biology.

Original publication

Osorio-Valeriano M., Altegoer F., Steinchen W., Urban S., Liu Y., Bange G., Thanbichler M. (2019) ParB-type DNA segregation proteins are CTP-dependent molecular switches. *Cell* 197: 1512-1524.

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Myxococcus xanthus cells expressing fluorescently labeled ParB (blue). Chromosomal DNA was labeled with DAPI staining (magenta).



Alumnus Report

My name is **Silke Bergeler**, I am a physicist by training and a former member of the TRR 174. During my master's studies in theoretical physics, I decided that I want to do research in theoretical biophysics, and I was lucky to become a member of Erwin Frey's group at the LMU in Munich. I really like about theoretical biophysics that it is a very diverse research field. Not only the research question and aim, but also the underlying physics may vary widely. For me it was important that I work directly together with biologists and aim my research at solving a biological question.

In my PhD I had the chance to do exactly this – I was working in a wonderful collaboration together with Dominik Schumacher and Lotte Søggaard-Andersen from the MPI in Marburg. Based on experimental data from Dominik, we developed a stochastic model to identify a possible mechanism for midcell localization in the bacterium

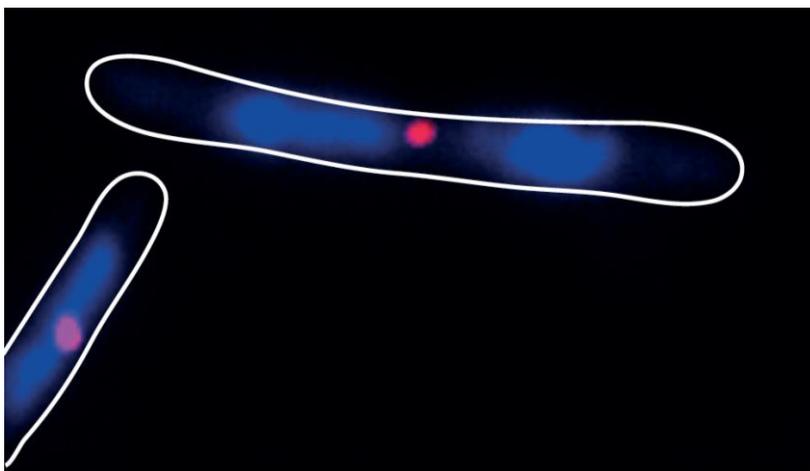
Myxococcus xanthus. Three proteins, PomX, PomY and the ATPase PomZ, co-localize in a cluster inside the cell and the cluster then moves towards midcell, where it positively influences the FtsZ-ring formation. We found that a mechanism based on the fluxes of the ATPase PomZ can explain the movement of the cluster to and localization at midcell. The TRR 174 started while I was working on this project and I was a member from the beginning on. I very much enjoyed the TRR retreats, conferences, lab exchanges and other get-togethers, which I perceived as great opportunities to exchange and develop new research ideas. After my PhD, I continued to work on this project by developing an automated image analysis procedure to simplify the quantification of experimental observations. Since I wanted to learn more about the data I analyzed, and due to curiosity, I had the idea to do fluorescence

microscopy experiments myself. I am very grateful to Lotte, who allowed me to do experiments in her lab for one month. It was a truly new and fascinating experience.

The next step for me is a postdoc in the group of Joshua Shaevitz at Princeton University. Since I very much enjoyed working interdisciplinary with biologists, I kept this direction, but with a change of fields. I will now work together with neuroscientists and analyze data on mouse behavior, which means again a lot of new and exciting things to learn!



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The bacterium *Myxococcus xanthus* (blue: the nucleoid; red: the Pom-Cluster).

Announcement: Money, Money, Money ...

Family and science - Both is possible!

In principle, men and women have equal opportunities in the German academic system. However, despite years of discussions and numerous initiatives to improve the career opportunities for women in science, we are still far from a situation in which male and female scientists have in fact the same chances of professional success. One reason is still the decision of starting a family. Here, the Transregio steps in and supports the career development of young scientists by providing a family-friendly environment. Often, the *arrival* of children coincides with the phase of life when the career demands are most intense and the budgets are too small to pay for domestic help or babysitters. To ensure that the scientific work of pregnant or parent PhD students or postdoctoral fellows is not interrupted or compromised, the Transregio offers support in different ways:

1. In the case of pregnancy, junior researchers can be supported with funding for student assistants to avoid unnecessary delays in their projects.

2. Once the child is born, the Transregio provides support for home office equipment, thereby allowing junior researchers (female and male) with children to carry on their research and meet their professional obligations without compromise.

3. Junior researchers with children will receive financial support for student assistants and/or a technical assistant to avoid a drop in productivity.

4. Junior researchers with children will receive support for childcare during conferences, project meetings, or in case of emergency.

What else would support your scientific career while having a family? Any idea is welcome and lot of things are possible to realize.

Publication - Keep the cost low!

Publish or perish. This commonly known term was probably used for the first time in an academic context in 1927 (Case 1927). In fact, the pressure to publish regularly is tremendous if you want to be successful in academia. Publishers, of course, know about the system and take advantage of that situation,

which often results in high publication costs. Here, the Transregio offers financial help: i) a maximum of 1,500 € is paid for joint publications including authors from different locations ii) a maximum of 1,000 € is paid for joint publications including authors from only one location, and iii) a maximum of 500 € is paid for all other publications. Just send us the publisher's invoice and you will promptly get reimbursed.

Lab visits - Travel and accommodation support!

Building up networks and to look beyond one's own lab is important to become a successful scientist. To this end, everyone who is associated with the Transregio can get financial support when visiting other TRR-labs, for: travel costs (train tickets, local bus/tram tickets) and accommodation. Just hand in your original bills and you will get refunded. Please note that the Transregio cannot pay daily allowance or food.

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AVERAGE TIME SPENT COMPOSING ONE E-MAIL



Have You Met ...

We are Svenja, Tanja and Carina, the **Office Marburg Team** of the Transregio 174. Together, we have broad experiences in a wide range of financial, administrative, and scientific fields. Our areas of responsibility are not strictly divided, rather we support and complement each other in our work.

Svenja Estor is our finance fairy. After finishing high school, she completed her education to become an office clerk. Afterwards, Svenja worked for two years for the MPI in Marburg and one year in a SFB at the Philipps University. Since summer 2019 she is working part time for the Graduate School 2213 Marburg. She joined the Transregio in August 2018 and is responsible for all financial affairs related to the TRR. In particular, Svenja takes care of the accounts, examines the calls for funds, handles the

annual where-used lists, and manages the gender equality funds as well as all travel costs. Svenja's favorite color is rose.

Tanja Fischer is our administrative queen. After her education as a foreign language secretary, she worked for 24 years in the free economy. While working mainly in the sales department of two big enterprises, Tanja was also responsible for the administrative and financial processes, as well as organizing exhibitions and customer relations. Since almost four years now, Tanja is working at the Philipps University Marburg in Prof. Thanbichler's lab. Right from the beginning she was involved in all administrative duties of the Transregio. Amongst many other things, Tanja is responsible for all general concerns related to the TRR and is experienced in organizing conferences and

workshops. Most important for Tanja are her two children.

Carina Marek is our newest team member. She studied biology in Bochum, finished her PhD 2015 in Giessen and specialized in molecular marine biology. After two postdocs and working as an alumni coordinator for the CEMarin, she joined the Transregio as a scientific coordinator in October 2019. Carina is supplementing the team especially in all scientific purposes. Moreover, she is the contact person for all PIs, postdocs and PhD students of the Transregio. She is organizing seminars, workshops and meetings and will be strongly involved in the preparation for the Transregio application for the second funding period. Carina's favorite animals are moon snails.



The Office Marburg Team (from left to right): Svenja Estor, Tanja Fischer and Carina Marek.

New Lab-Equipment

In 2019, new large lab-equipment was bought for the Transregio. If you are interested to use one of those tools for your analyses, simply contact the respective person responsible.

nanoDSF-technology *Prometheus NT.48* (NanoTemper)

Your samples are of small amounts, contain low or high concentration, or are viscous? No problem for the Prometheus NT.48. Prometheus generates precise unfolding temperatures (T_m and T_{onset}), critical denaturant concentrations (C_m), free folding energy (ΔG and $\Delta\Delta G$), and aggregation results (T_{agg}). It provides comprehensive results for any type of protein—small or large molecules, biologics, enzymes, antibodies, ADCs and membrane proteins—and is es-

pecially good at screening buffer conditions or testing formulation and storage conditions. Moreover, Prometheus characterizes thermal and chemical unfolding under native conditions using nanoDSF technology.

See <https://nanotempertech.com/prometheus/> for more information and for ordering the capillaries.

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Isothermal titration calorimeter *MicroCal PEAQ-ITC* (Malvern Panalytical)

The MicroCal PEAQ-ITC is a highly sensitive, low volume isothermal titration calorimeter for the label-free in solution study of biomolecular interactions. It is designed for ease-

of-use and exceptional sensitivity. The system directly measures heat released or absorbed during biochemical binding events, from which it calculates binding affinity (K_D), stoichiometry (n), enthalpy (ΔH), and entropy (ΔS). The wide affinity range enables analysis of weak to high affinity binders, with excellent reproducibility. A wide range of applications can be investigated with MicroCal PEAQ-ITC, including characterization of molecular interactions of small molecules, proteins, antibodies, nucleic acids, lipids and other biomolecules. It can also be used to measure enzyme kinetics.

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About the TRR 174 (www.trr174.org)



The head office of the TRR 174 is located in the New Chemistry Building of the Philipps University Marburg, Germany.

TRR 174
Spatiotemporal
dynamics of bacterial cells

The TRR 174 is a DFG-funded collaborative research center. 16 research groups, located in the Marburg and Munich areas, have joined forces to establish a Transregio-CRC with a comprehensive and highly coherent research program to investigate the molecular mechanisms controlling the spatiotemporal dynamics of bacterial cells. These include the spatiotemporal dynamics of cell division site placement, cell

growth and morphogenesis, chromosome organization, DNA segregation, the positioning of motility structures, and the dynamics of (membrane) protein assembly. Joint activities ensure interdisciplinary research and close ties between the groups as well as a comprehensive postgraduate training program for all associated PhD students.

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The TRR 174 news is a quarterly newsletter of the Transregio Collaborative Research Center. For contributions to the newsletter, please contact Carina Marek (marekc@staff.uni-marburg.de). The next issue will be released in May 2020. Editorial deadline is 15 April 2020.