TRR 174 Newsletter

Spatiotemporal dynamics of bacterial cells

Time To Say Goodbye …

Dear all,
I am sad to announce that this will be the last issue of our TRR 174 Newsletter. Since our Transregio is in its final stage, our finance fairy Svenja and myself had to find a new adventure … which each of us finally did. Tanja will stay ahead, securing a smooth running of the Transregio until the end. However, we thank you for the time and efforts you invested in making our joint venture a great success! All the best.

Your TRR 174 Admin-Team

Svenja, Tanja & Carina

Time to say goodbye - Interview

Tanja: **You worked for three and one and a half years for the TRR 174, respectively … What were the greatest challenges you had to overcome?**
Svenja: The where-used list (*Verwendungsnachweis*)! In particular the reconciliation of the different institutional accounts was a kind of puzzle-game every year.

Carina: In the beginning the names. But by now I know all of you – first- and surnames! My second challenge until now is to get students excited about the Progress Seminar ☺

Tanja: **What will you miss the most?**
Svenja & Carina: Our great time together in the office and in private … the many laughter we shared ...

Tanja: **I meant regarding the Transregio …**
Carina: Well, the great team spirit we experienced during the last four years. We can look back on many memorable events, workshops, retreats and conferences. Our seminar series was a pleasure to organize. We welcomed many great speakers and I appreciated to work together with Tarryn and Carmen (MPI Marburg) to make it a smooth and successful event. Moreover, I enjoyed working together with Dusica (IMPRS-Mic) and MARA (Marburg University Research Academy) to offer our students a comprehensive course programme.

Tanja: **Where can we find you, if we wanna come over for a coffee?**
Svenja: 1st April I started as administrator for the pharmacology department at BPC, affiliated to the group of Prof. Worzfeld, located between the botanical garden and biology building (here at the Lahnberge).

Carina: Nothing is signed yet, but probably 1st June I will start as the new scientific coordinator for TRR 247 "Heterogeneous Oxidation Catalysis in the Liquid Phase" at the University Duisburg-Essen. You are very welcome to visit. There will always be coffee waiting.

Tanja: **You wanna say few last words?**
Carina: I enjoyed being part of a great consortium. I learned a lot about the fascinating world of bacteria, met great people, experienced real teamwork and appreciated the very open, friendly and trustful working atmosphere. Wishing you all success in your (future) projects, plans, and careers. Thank you all for a wonderful time.

Svenja: Thank you all for a great time. Ciao cacao ☺

Paper Report

Stable inheritance of *Sinorhizobium meliloti* cell growth polarity requires an FtsN-like protein and an amidase

Bacterial cell growth requires precisely controlled extension of the cell wall. Many rod-shaped bacteria grow by dispersed cell elongation, whereas bacteria from the order Rhizobiales including *Sinorhizobium meliloti* exhibit unipolar growth. The latter is characterized by the insertion of new cell wall material at the new cell pole, generated during cell division. Whereas dispersed cell wall growth is well-characterized, the molecular mechanisms of bacterial polar growth are an emerging research field.

Recently, we identified novel rhizobial growth and septation (Rgs) proteins, essential for proliferation and associated with cell wall growth zones at the septum and the new cell pole. Among a total of 11 Rgs proteins with mostly enigmatic functions, RgsS stood out because of its distant similarity to *E. coli* FtsN. FtsN is an essential cell division protein, able to bind amidase-processed (denuded) peptidoglycan via a conserved SPOR domain and also to activate cell division-specific peptidoglycan biosynthesis.

In this study, we uncovered the role of RgsS and peptidoglycan amidase AmiC in faithful placement of the unipolar cell wall growth zone at the new cell pole of *S. meliloti*. Our findings imply that RgsS is able to bind AmiC-processed peptidoglycan at the septal site and the new cell pole via its SPOR domain and that this interaction stabilizes RgsS positioning. Anchored at the new cell pole, RgsS could hallmark it for assembly of the polar cell wall elongation machinery.

We show that peptidoglycan processing by AmiC is not only promoting cell division, but is also likely to be involved in cell elongation. We also report on a new EnvC-like protein AmcA serving as AmiC cofactor. In the absence of either RgsS SPOR domain or AmiC, the mobility of RgsS molecules increased, enabling their accumulation at the old cell pole. Placement of RgsS at the old cell pole proceeded conjointly with other Rgs proteins as well as the cell wall growth zone. It ultimately resulted in cells with inverted growth polarity, elongating their cell wall at the old instead of the new cell pole.

In cells with inverted growth polarity, following replication initiation, migration of the second chromosomal origin of replication towards the non-growing new cell pole (opposed to migration towards the growing cell pole in cells with normal growth polarity) was partially impaired. The exact nature of the functional connection between polar growth zone factors and genome segregation machinery is awaiting discovery.

Original publication:
Krol E, Stuckenschneider L, Kästle Silva JM, Graumann PL & Becker A (2021) Stable inheritance of *Sinorhizobium meliloti* cell growth polarity requires an FtsN-like protein and an amidase. *Nat Commun,* **12**: 1-12.

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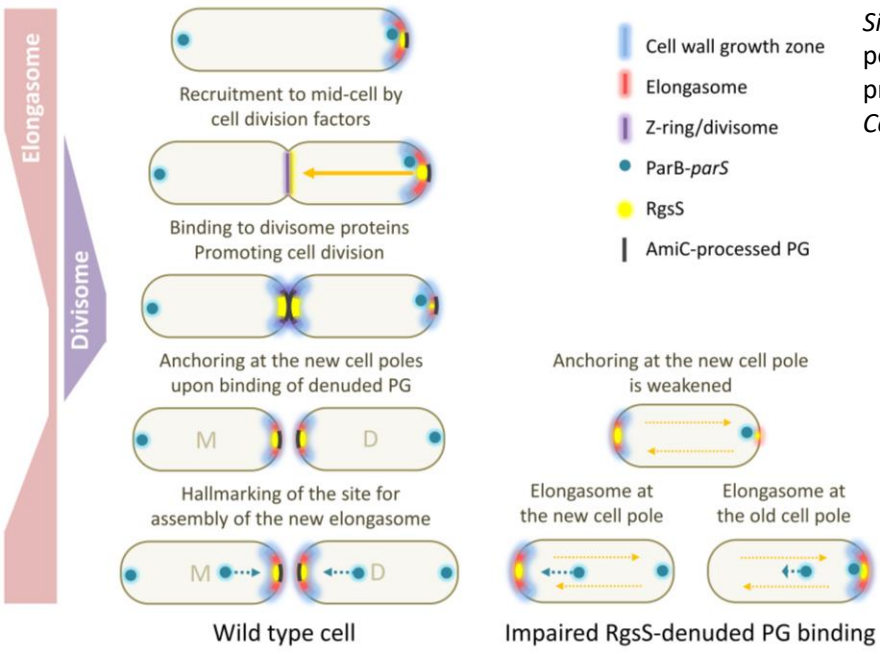

Figure: Proposed role of RgsS in stable inheritance of cell growth polarity

Alumnus Report

I am Muriel van Teeseling and after my previous roles in TRR 174 as postdoc in the Thanbichler lab, member of the young scientists committee and co-organizer of the two conferences, I recently changed my status to alumnus. Already during my studies in Nijmegen (the Netherlands), I combined biology, in which I obtained my MSc, and some physics, for which I finished the first year as a hobby in my spare time. My PhD focused on the cell biology of the environmentally abundant and relevant anammox bacteria, which possess an intracellular organelle that acts as an energy factory for the cell. During my postdoc in the lab of Martin Thanbichler, I studied the cell biology of multiple Alphaproteobacteria.

My main model organism, was *Hyphomonas neptunium*. This bacterium has a remarkable way of dividing its cells: the daughter cell arises from the tip of a tube (called stalk) that this bacterium grows at one of its poles. We attempted to understand which adaptations have led to this remarkable morphology and cell division. By studying the localization of many proteins involved in cell division using the fluorescent microscope, we are starting to understand where the stalk might have originated from and which role it plays in cell division. Right now we are wrapping up the manuscript that will hopefully be published soon.

In collaboration with the group of Anke Becker, we also investigated which adaptations *H. neptunium* underwent to segregate its chromosome through the stalk in preparation of cell division. Our love of chromosome organization (and a shared nationality, at least for me) brought us together with the group of Chase Broedersz. The collaboration with Joris, Karsten and Chase was lots of fun and led to a nice paper on chromosome organization of *Caulobacter crescentus* that got published in Nature Communications a few days ago.

Being part of TRR 174 has always been a pleasure for me and I have thoroughly enjoyed learning about the research and angles of all the members towards answering interesting research questions. I now take all the experience I obtained in bacterial cell biology and a hugely extended network of microbiologists and biophysicists into my new job. In January this year, I started my own independent research group named "Prokaryotic Cell Biology" at the Friedrich-Schiller University Jena. We are studying cell biological adaptations that bacteria undergo in response to their environment, especially when living together with other organisms. I enjoy being part of one of the other German microbiology hubs and I am happily learning about microbial communication from my new colleagues, including Kai Papenfort, who was also a member of TRR 174. In case one of you is ever in Jena, would like to collaborate on exciting prokaryotic cell biology topics, or would like to co-organize an event to bring together our community, I would be happy to get in touch.

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About TRR 174 (*www.trr174.org*)

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

TRR 174 is a DFG-funded Transregional Collaborative Research Center. In this consortium 16 research groups, located in the Marburg and Munich areas, have joined forces to implement a comprehensive and highly coherent research program that investigates the molecular mechanisms controlling the spatiotemporal dynamics of bacterial cells. Joint activities ensure interdisciplinary research and close ties between the groups as well as a comprehensive training program for all associated PhD students.

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