Scientists discover new concept of bacterial gene regulation

August 6 2020

Microbiologist Kai Papenfort from the University of Jena (Germany). Credit: Anne Günther/University Jena

Bacteria are always with us: These tiny organisms are found within and on our body as is the case with all animals and plants. As part of a

healthy microbiome they ensure our wellbeing. But if the microbial community gets dysbalanced, infections can follow. Even in soil and water they are a crucial component of the respective environments and their functioning.

Still, we are just beginning to understand these essential unicellular organisms. The Jena microbiologist Prof. Kai Papenfort and his team were able to shed more light on this subject with their latest publication in the journal eLife. They discovered a new mechanism of autoregulation during gene expression that relies on small regulatory ribonucleic acids (sRNAs) and the major endoribonuclease RNase E.

"This autoregulation controls gene expression—that means, the proteins are synthesized based on genetic information. Bacteria use this process to adapt to their environment for example," explains Papenfort, Chair of General Microbiology at the Friedrich Schiller University Jena. The sRNAs play a decisive role in gene regulation. Through their interaction with the messenger RNA they influence the structure or metabolism of the bacterium, among other things.

"Based on the collected data, we were able to show that sRNAs from a specific section of the messenger RNA serve as autoregulatory elements. That allows negative feedback control at the post-transcriptional level," says Papenfort. Negative feedback regulation is very common in biology. It often has a stabilizing effect. For example, in humans both the regulation of body temperature and blood pressure are due to negative feedback regulation. Normally, the feedback controls are triggered by the corresponding proteins during transcription. "It is notable, that the autoregulatory small RNAs we have discovered are independent of auxiliary transcription factors. Therefore, they provide a more rapid response," continues Papenfort.

With the findings from this study, Papenfort's team contributes to the

research of the Cluster of Excellence "Balance of the Microverse" at the Friedrich Schiller University Jena. Its goal is to generate a holistic understanding of microorganisms, their interaction and communication with each other and with their environment.

More information: Mona Hoyos et al, Gene autoregulation by 3' UTR-derived bacterial small RNAs, *eLife* (2020). DOI: 10.7554/eLife.58836

Provided by Friedrich Schiller University of Jena