**MS05-1-2 Uncovering the role of protein HelD in bacterial transcription – the growing picture based on structural and functional data**
**#MS05-1-2**

J. Dohnálek [1], T. Kouba [2], T. Kovaľ [1], P. Sudzinová [3], J. Pospíšil [3], H. Šanderová [3], M. Trundová [1], B. Husťáková [1], K. Murakami [4], L. Krásný [3]

**[1]Institute of Biotechnology, Czech Academy of Sciences - Vestec near Prague (Czech Republic), [2]Institute of Organic Chemistry and Biochemistry, Czech Academy of Sciences - Prague (Czech Republic), [3]Institute of Microbiology of Czech Academy of Sciences - Prague (Czech Republic), [4]Pennsylvania State University - State College (United States)**

**Abstract**
RNA synthesis is central to life. The complex responsible for RNA synthesis – RNA polymerase (RNAP) – depends in its function on a number of accessory factors, some of which play a role in recovery from stalled states and adaptation to environmental changes. The helicase-like protein HelD discovered in 2011 [1] has been shown to be a multi-domain partner of RNAP [2,3], capable of tight binding to RNAP in an unprecedented manner [4]. The current picture of the HelD structure-function relationship has been so far depicted using small angle X-ray scattering, crystallography and Cryo-EM, together with biophysical measurements, and specifically designed transcription assays. Our cryo-EM structure of a complex between the *Mycobacterium smegmatis* RNAP and HelD shows the crescent-shaped HelD simultaneously penetrating deep into two RNAP channels that are responsible for nucleic acids binding and substrate delivery to the active site, thereby locking RNAP in an inactive state. Three structural classes suggest three states of the process of HelD binding to RNAP and of its interference with transcription. HelD is expected to help release RNAP from stalled elongation complexes. While the mechanism of its binding and nucleic acids release is largely explained by the current results, the mechanism of HelD unbinding from RNAP is yet to be explained. New structural and functional data bring insights into the intereference of HelD with the transcriptional cycle of RNAP and the role of its so far not fully understood NTPase activity.

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