MPI-NAT SEMINAR SERIES


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Dynamic RNA biology at the single-molecule level: Watching how interconnected processes work in real-time

A central question in biology is how macromolecular machines function cooperatively.
In the first part, I will show our recent work investigating how bacterial transcription and translation cooperate. We have reconstituted a complete and active transcription-translation system and developed multi-color single-molecule fluorescence microscopy experiments to directly and simultaneously track transcription elongation, translation elongation and the physical and functional coupling between the ribosome and the RNAP in real-time (Qureshi & Duss, Nature, 2025). A main finding is that the ribosome and the RNAP can communicate with each other by mRNA looping, providing an alternative explanation on how the ribosome can efficiently rescue RNAP from frequent pausing without requiring collisions by a closely trailing ribosome.
In the second part, I will discuss our work on understanding how the bacterial rRNA transcription antitermination complex (rrnTAC) coordinates early co-transcriptional rRNA processing. By directly tracking rrnTAC assembly and co-transcriptional RNase III cleavage in real-time, we show how the presence of the completely assembled rrnTAC facilitates RNase III cleavage by bringing 5'- and 3'-end of the rRNA spatially close, thereby chaperoning the long-range RNA helix which is the substrate for RNase III. This is the first direct experimental evidence of coupling between rRNA transcription and processing in bacterial ribosome assembly mediated by long-range rRNA looping.
Depending on time, I may also show some preliminary work on our efforts to understand eukaryotic RNA biology, specifically how biomolecular condensates (paraspeckles) are assembled during the process of transcription.

Thursday, 27.11.2025, 1:00 pm

Host: Kristina Žumer

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