Seminar/Talk

The structure of bactofilin filaments and other wonders of the bacterial cytoskeleton

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Host: Martin Loose

Most, if not all bacterial and archaeal cells contain at least one protein filament system. While these filament systems in some cases form structures comparable to eukaryotic cytoskeletons, the term prokaryotic cytoskeletons is used to loosely and non-exhaustively refer to many different kinds of protein filaments united by the functional properties which stem ultimately from polymerisation, and the resulting ability to access length scales bigger than the size of the monomer. Prokaryotic cytoskeletons are involved in many fundamental aspects of cell biology, and are most prevalent in processes of cell shape determination, cell division, and non-chromosomal DNA segregation. Some, but by no means all, of the filament-forming proteins fall into a small number of conserved groups, in particular the almost ubiquitous tubulin and actin families that also include ubiquitous eukaryotic F-actin and microtubules. Bactofilin proteins form filaments and are widespread amongst prokaryotes, but do not belong to the tubulin and actin superfamilies. Discovered only a few years ago, their functions in cells remain loosely defined, appearing as spatial organisers close to bacterial membranes. Bactofilins polymerise from small beta-helical subunits, but the precise filament architecture and the nature of their membrane localisation have remained elusive.We have solved the structure of bactofilin filaments from T. thermophilus to 4 Å by cryo-EM, showing continuous beta helical tubes that are made from subunits in a head-to-head arrangement, leading to non-polar filaments. Mutating one filament interface leads to non-polymerising dimers that we could crystallise, re-enforcing the non-polar nature of the native filaments. We show that T. thermophilus bactofilin, and most likely all bactofilins, binds liposomes and membranes directly. Hydrogen exchange coupled with mass spectrometry indicates that both N-and C-terminal tails of bactofilin are disordered and through a number of experiments we show that the filaments bind membrane through the N-terminal tail. We also demonstrate that some fungi contain polymerising bactofilin domains, indicating that these filaments are not restricted to prokaryotes.To showcase the surprising diversity of the bacterial cytoskeleton, I will also present recent data on bacterial mini microtubules (BtubAB) and a cryo-EM structure of MinCD filaments.

Friday, January 18, 2019 01:00pm - 02:00pm
Mondi Seminar Room 2, Central Building

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