Control of shape and size in rodlike bacteria

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***Short Abstract* — The shape of most bacteria is determined by the peptidoglycan cell wall, a single huge molecule that counteracts the turgor pressure inside the cell. In the case of the Gram-negative bacterium *Escherichia coli*, much is known about the enzymes and biochemistry of cell wall synthesis, and, recently, cryotomography experiments have revealed structural features of the cell wall in new detail. However, the dynamical mechanisms by which the cell achieves and maintains its shape during growth are still not understood.**

An important role for shape maintenance is clearly played by the cytoskeletal protein MreB, an actin homolog that forms a helical bundle along the inner membrane of the cell. If MreB is depleted, *E. coli* loses its rodlike shape. Could MreB serve as a ruler for cell wall synthesis? In order to resolve this question we studied the interplay of MreB with a second protein, the periplasmic penicillin-binding protein PBP2, which is an essential enzyme for peptide bond formation in the periplasm. In particular, we present results on the structure and dynamics of these two proteins and discuss their interaction and their role in cell shape determination.

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