Prof. Dr. Petra Schwille

MPI of Biochemistry Martinsried

Symmetry breaking and pattern formation in minimal biological systems

One of the most distinctive features of living systems is the ability to create order and spatial structures out of seemingly equilibrated systems in the aqueous environment. The relatively simple mathematical conditions for symmetry breaking and pattern formation were formulated in 1952 by Alan Turing, in order to describe biological morphogenesis. However, to date only few self-organizing biological systems have been identified that were indeed simple enough to fulfill the conditions for Turing patterns, and to be quantitatively described on basis of few parameters. One of these systems is the MinCDE protein machinery, which orchestrates the positioning of the division ring in *E.coli* bacteria. The Min proteins show a distinct oscillation of protein concentrations between the two cell poles, which are based on self-organization through reaction-diffusion. We have been able to constitute these self-organized oscillations of purified proteins in artificial cell-shaped compartments, as well as the faithful downstream positioning of protofilaments of the Z division ring. This could be the first step towards autonomous division of an artificial cell system which we aim to establish in a bottom-up synthetic biology approach.