High-resolution imaging and force probing of extracellular fibers in biofilms
International Master thesis project joint between Pasteur Institute, Paris, Weizmann Institute, Israel, and the LMU Munich

Bacteria in biofilms are physically connected to each other via extracellular filaments made of amyloid-like proteins [1]. These protein filaments are important for the mechanical stability of the biofilm. In preliminary work we have visualized amyloid fibers in biofilms of the bacterium *Bacillus subtilis* by engineering a fluorescent-protein fusion to the amyloid-forming protein TasA (Fig. 1). In this project we aim to study the process of TasA secretion and fiber formation at high resolution using advanced fluorescence microscopy and recently identified molecules to trigger fiber disassembly [2].

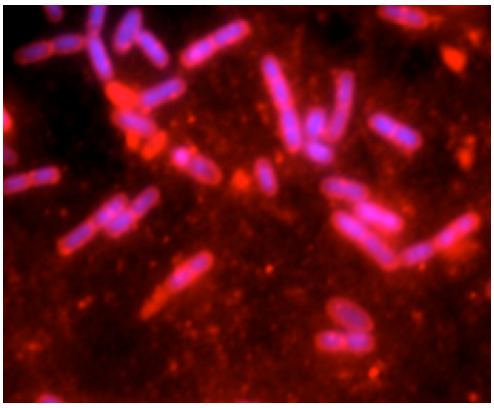

Fig. 1: Filamentous TasA proteins decorating *Bacillus subtilis* in a growing biofilm.

Apart from providing mechanical rigidity to the biofilm, amyloid fibers might serve as force sensors that allow cells to sense their environment. The force exerted on the bacterium could trigger a cascade of signaling events inside the cell. We aim to exert force on the bacteria via the fibers, using magnetic tweezers and subsequently probe the response of specific candidate genes using transcriptional fluorescent-protein reporters.

This project is a collaboration between the labs of Jan Lipfert, Ilana Kolodkin-Gal, and Sven van Teeffelen (see contact info below). The work will be carried out largely at the Instiut Pasteur in Paris. We are looking for a highly motivated student with a background in physics or chemistry who is interested in interdisciplinary work and has a solid background in programming. If you are interested, please contact Jan Lipfert or Sven van Teeffelen, including a brief CV and transcript.

Contact:
Sven van Teeffelen (sven.van-teeffelen@pasteur.fr), Institut Pasteur, Paris
https://research.pasteur.fr/en/team/microbial-morphogenesis-and-growth/
Jan Lipfert (jan.lipfert@lmu.de), Molecular biophysics, LMU Munich
http://www.molecularbiophysics.physik.lmu.de
Ilana Kolodkin-Gal, Weizmann Institute of Science, Rehovot, Israel
http://www.weizmann.ac.il/molgen/Kolodkin-Gal/

References
[1] Romero, D., Aguilar, C., Losick, R., & Kolter, R. (2010). Amyloid fibers provide structural integrity to Bacillus subtilis biofilms. *PNAS*, *107*(5), 2230-2234.
[2] Kolodkin-Gal, I., Romero, D., Cao, S., Clardy, J., Kolter, R., & Losick, R. (2010). D-amino acids trigger biofilm disassembly. *Science*, *328*(5978), 627.

Institut Pasteur LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN Weizmann Institute of Science