Morphogenesis of the diplococcus *Neisseria meningitidis*

A very fundamental question in cell biology consists in understanding how cells grow and divide into a given shape to perform specific cellular functions. Shape diversity in the bacterial world implies that different mechanisms exist to guide proper cell growth, division and chromosome segregation. Although the majority of studies on cell division have focused on rod-shaped cells, and more recently on cocci, the development of new genetic and cell biology tools has provided mechanistic insight into the cell cycles of bacteria with different shapes, allowing us to appreciate the underlying molecular basis for their morphological diversity.

In this project, we will focus on a **poorly studied cellular shape: the diplococcus**, a "grain" that occurs in the group of two. For this, we will characterize **bacterial growth and division in the gram-negative bacterium *Neisseria meningitidis*.** More specifically, we will investigate how proper chromosome segregation is coordinated with cell wall synthesis and the proper localization of the cell division machinery. Thanks to our expertise in Neisseria genetics, we have generated a variety of bacterial strains expressing fluorescent reporters of cellular components to quantitively characterize their dynamic distribution during cell growth and division by high resolution live cell microscopy. The optimization of recent methods developed in yeast and eukaryotic cells will allow to access to direct measurements of bacterial volume and molecular crowding in single proliferating cells. These experiments will be performed in the wild-type strains and in mutants lacking regulators of cell shape and cycle. Data will then be quantified by using custom-built segmentation and analysis tools developed in the lab, which are mostly based on the use of Python, Fiji and Matlab. This internship is part of Laure Le Blanc's ongoing PhD project in the lab, that focuses on the physical and physiological impact of confinement on bacteria.

Methods used:

High-resolution live microscopy, image analysis (Python, Fiji and Matlab-based) and modeling. Last-generation microscopy (FLIM-FRET, SIM, STORM) as well will be available on the Photonic Bioimaging Platform in Pasteur.

Knowledge & Skills

Background knowledge in the fields of cell biology, biophysics and/or microbiology is required. Prior experience with image analysis will be a strong plus.

Lab:

This project will be hosted in the Pathogenesis of Vascular infections Unit (https://research.pasteur.fr/en/team/pathogenesis-of-vascular-infections/, Head: G. Duménil) at Pasteur Institute, and supervised by a young investigator with an expertise in the biophysics of infection, Daria Bonazzi. The candidate will be integrated in an interdisciplinary team that combines biochemistry, microbiology, cell biology, biophysics and animal models of infection.

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