Project 3.5 Growth and evolution of biofilms

Supervisor: prof. dr hab. Robert Hołyst / dr Bartłomiej Wacław
Laboratory: Research group No. 15. Dioscuri Centre for Physics and Chemistry of Bacteria - dr Bartłomiej Wacław
www: https://dioscuricentrebacteria.com/

Background:

Biofilms are surface-attached conglomerates of microorganisms. Biofilms are ubiquitous in nature; they can be found on rocks, water pipes, teeth, medical implants and catheters, and other surfaces that are permanently or temporarily submerged in water. Biofilms are often undesired: they contaminate surfaces, clog industrial and medical systems, cause animal and human infections. Moreover, new genetic variants that spontaneously emerge in biofilms contribute to the problem of antimicrobial resistance.

Despite decades of research it is still unclear how different physical and chemical factors affect biofilm formation, growth, and evolution. A better understanding of these processes is not only interesting from the fundamental research viewpoint but may also help develop novel strategies of combatting biofilm formation and the evolution of undesirable genetic variants within the biofilm.

Aim:

In this project you will investigate how physical and chemical factors affect biofilms growth, its 3d structure, and population dynamics of new genetic variants in a laboratory, microfluidics-based experimental model. In year 1 you will explore several possible directions, including (but not limited to) biofilms growing on dynamically deforming surfaces, biofilms on micro-patterned surfaces, biofilms on surfaces treated with anti-adhesive coatings. You will establish through the literature search and simple pilot experiments which of these options could lead to novel, interesting results. In years 2-4 you will be expected to conduct a detailed research into the role of at least one of the factors mentioned above: quantitatively determine how it affects the biofilm, understand the mechanism through which it operates, and propose how the mechanism could be exploited for industrial or medical purposes.

Requirements:

- Msc in biology, chemistry or physics,
- prior experience in microbiology, soft lithography and fabrication of PDMS-based microfluidics devices,
- basic knowledge of microscopic optical imaging techniques and image processing