Influence of physical heterogeneity of flow on microbial horizontal gene transfer in subsurface ecosystems

Stéphane Mahé*[1] and Pietro De Anna†

[1]Université de Lausanne (UNIL) – CH-1015 Lausanne, Switzerland

Abstract

Microbial life in the subsurface environment face changes stemming from human activities such as the use of antibiotics and pesticides, or industrial contamination. There, the physical structure changes across distances of a few micrometers creating a multitude of microenvironments where abundant bacterial species thrive under fluctuating conditions. Porous media such as soils consist in a distribution of pores fulfilled by fluids such as gases or liquids characterised by flow dynamics. This physical system is coupled with the microbial life. For example, fluid flows transport resources creating gradients affecting spatial distribution of bacteria which in turn through planktonic biomass growth or the development of a biofilm can modify the dynamics of fluid flow. Bacteria demonstrated adaptability through rapid evolution processes. Competent bacteria have the ability to uptake free DNA from their environment and to express it, a mechanism of gene transfer known as natural transformation. Here we investigate the influence of fluid flow on transformation as water is a critical component for most of the soils and may contribute to the dispersion of free DNA. We combined microfluidics methods with fluorescent optical microscopy in order to have a dynamic visualization of bacteria expressing fluorescence from free plasmids. Microfluidics chips were used to allow the control of hydrodynamic parameters in small confined environment. Then numerical treatment of images was applied to render the efficiency of the transformation under different flow conditions. This method is very promising to study this critical process source of biodiversity with naturally competent bacteria species involved in soil key processes.

*Speaker

†Corresponding author: pietro.deanna@unil.ch