PROPOSITION DE STAGE

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Niveau : M2
Intitulé du stage : **Biofilms growth and force generation**

Mots clés:
Physique, Théorie, Modélisation, Physique Nonlinéaire, Physique Statistique Hors Equilibre, Biophysique

Résumé:
Bacteria and other micro-organisms often organize as a community within a thin film called biofilm. The understanding of the formation and growth of biofilms is crucial for the food industry (e.g., salmonella), for healthcare (e.g., dental plaque), and in geology (e.g., stromatolites).
The physical behavior of the growth of biofilms has been recently investigated within thin film models, based the modeling of the dynamics via non-linear partial-differential equations [1,2]. These models have revealed the crucial role of simple physical ingredients such as osmotic pressures and surface tension. The aim of these project is to study the dynamics of growing biofilms, using the tools of nonlinear dynamics and non-equilibrium statistical physics. Our central aim will be to identify the forces that can be produced by the biofilm on their environment during growth. The work will consist in two parts. First, we will derive a suitable model based on an asymptotic analysis. Second, we will integrate the resulting equations numerically to investigate the growth process and the resulting forces.

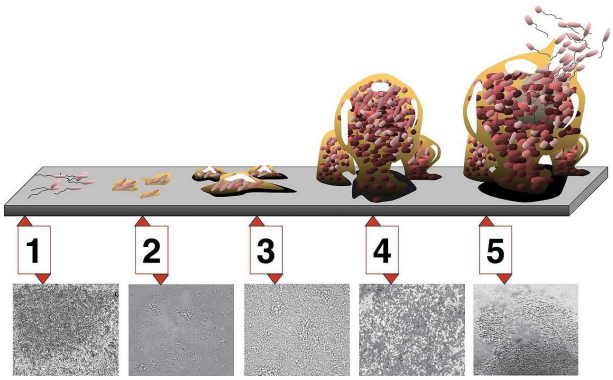

Figure: Different stages of the evolution of a biofilm. [from Monroe D (2007) PLoS Biol 5(11): e307.]

[1] Bacterial biofilm shows persistent resistance to liquid wetting and gas penetration, Alexander K. Epstein, Boaz Pokroy, Agnese Seminara, and Joanna Aizenberg, PNAS 108 995 (2011).

[2] Continuous versus arrested spreading of biofilms at solid-gas interfaces: The role of surface forces
S Trinschek, K John, S Lecuyer, U Thiele - Physical review letters, 119, 078003 (2017).

Possibilité de poursuite en thèse : Oui