MICROBIOLOGIE, INFECTIOLOGIE ET IMMUNOLOGIE

Université de Montréal

CONFÉRENCE

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Mechanisms of bacterial attachment to surfaces: from surface sensing to the biophysics of adhesion

Surface association provides numerous fitness advantages to bacteria. Ubiquitous microbial appendages called pili are involved in sensing surfaces and mediating downstream surface-associated behaviors. The mechanism by which pili mediate surface sensing remains unknown, largely due to the difficulty to visualize their dynamic nature and to directly modulate their activity without genetic modification. We have developed a broadly applicable pilus labeling method enabling real-time observation of pilus dynamics and targeted physical obstruction of this activity. We found that *Caulobacter crescentus* tad pili undergo dynamic cycles of extension and retraction despite the absence of an orthologous retraction ATPase. Pili dynamic activity ceases within seconds of surface contact, and this arrest of activity coincides with surface-stimulated holdfast synthesis. By physically blocking pili, we show that imposing resistance to pilus retraction is sufficient to stimulate holdfast synthesis in the absence of surface contact. Thus, resistance to type IV pilus retraction upon surface attachment is used for surface sensing. After its export, the holdfast mediates adhesion to surfaces with impressive strength, surpassing the performance of industrial glues. I will describe our recent discovery that the holdfast is a heterogeneous material composed of two layers: a stiff nanoscopic core, covered by a sparse, flexible brush layer. These two layers contain *N*-acetyl-*D*-glucosamine (NAG), peptides, and DNA. Polypeptides are the most important components for adhesive force, whereas DNA mainly impacts the brush layer and initial adhesion, and NAG plays a structural role within the core. While the holdfast of the freshwater *Caulobacter* loses adhesiveness even at low ionic strength, the holdfast produced by a marine species retains adhesiveness at high ionic strength, indicating potential for the development of medical and dental bioadhesives.

Jeudi 23 novembre 2017 à 11 h 30
Pavillon Roger-Gaudry, salle P-217

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