MICROBIOLOGIE, INFECTIOLOGIE ET IMMUNOLOGIE

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CONFÉRENCE

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Understanding bacterial cell shape and cell-envelope integrity

Proper cell shape and cell-envelope integrity are important for all organisms. In bacteria, cell shape and mechanical integrity are physically determined by the peptidoglycan cell wall. Accordingly, the cell wall is a major target for antibiotic therapy. While we know a lot about the enzymes responsible for cell-wall remodeling at the genetic and biochemical level, we still don't understand how the activity of microscopic enzymes reliably leads to macroscopic shape. To answer this and related questions, my lab uses a combination of approaches from physics and biology, with a focus on high-precision live-cell microscopy.

In *E. coli*, two sets of machineries are essential for cell-wall insertion in the cylindrical part of the cell, the multi-protein Rod complex, which is physically linked to the MreB-actin cytoskeleton, and the bifunctional class-A PBPs. Studying these two systems at the single-molecule level, we could reveal important features: First, we found that the Rod complex initiates and localizes in response to local features of the cell envelope that are different from the MreB-actin cytoskeleton, overturning previous suggestions and constraining physical models of rod-like cell shape. Second, we could demonstrate that class-A PBPs have no role in shape maintenance but repair cell-wall defects within minutes. This activity is particularly important during cell-wall stress.

Classically, cell-wall insertion and cell-wall expansion are thought to be strictly coupled in Gram-negative bacteria. Instead, we found that *E. coli* expands its cell envelope independently of cell-wall insertion, if insertion is inhibited through antibiotics, up to the point of cell lysis. Furthermore, envelope expansion is robustly coupled to biomass growth. These results highlight the important and previously under-appreciated role of cell-wall cleaving autolysins for bacterial morphogenesis and point towards unknown fundamental connections between cellular physiology and envelope remodeling.

Together, our findings reveal important design features of bacterial morphogenesis and cell-envelope homeostasis.

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Diffusion en ligne: Inscription requise à l'avance auprès de Mme Danielle McCarthy (danielle.mccarthy@umontreal.ca)

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