

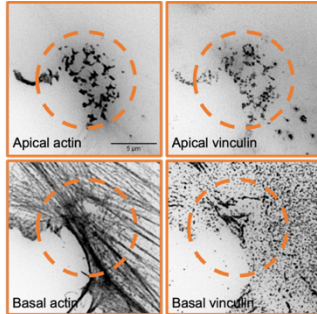
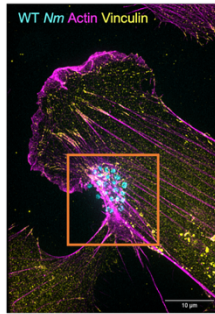
M2 internship proposal:

How a bacterial pathogen mechanically manipulates its host

Team: **"Quantitative cell Biology of Bacterial Infection"**

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Context



Bacterial pathogens cross tissue barriers by physically interacting with them, yet infection biology still describes this almost entirely in molecular terms. *Neisseria meningitidis*, a gram-negative bacterium responsible of meningitis and septic shock in humans, adheres to the apical surface of host cells in microcolonies and retracts its Type-IV pili (T4P) with forces among the strongest known for a single biological motor. We have recently shown that these pulling forces modulate host cell contractility through

a new actin rich structure, called *Ancreopodia*. How that force is sensed, and what it does to the cell, is still an open question.

Hypothesis

The student will assess whether T4P retraction forces are transmitted through the apical glycocalyx to the spectrin cortex. This could locally raise membrane tension and gate the mechanosensitive channel Piezo1 - redistributing RhoGTPase activity and driving the contractility changes we observe.

Experimental Plan

- 1. The apical mechanotransduction module.** Determine whether the glycocalyx, Piezo1 and the spectrin cortex are required to convert bacterial force into a host response. Glycocalyx trimming by enzymatic treatment; Piezo1 tested by Ca^{2+} imaging during live adhesion with pharmacological agonist and blockade; spectrin remodelling imaged under microcolonies.
- 2. RhoGTPase rewiring.** Map where RhoA, Rac1 and Cdc42 activity relocates on bacterial binding, and test whether it depends on the components identified in the first part.

We will take advantage of a panel of bacterial mutants that separate binding from pulling: wild type, a hyperpiliated strain that pull more strongly and a retraction-deficient mutant that still adheres (ΔpilT). This will allow to assess whether the host cell senses T4P retraction rather than simply bacterial adhesion, and what are the mechanical consequences of this process.

Methods and training

Traction force microscopy, micropatterning, live confocal imaging with Ca^{2+} and membrane-tension reporters, immunostaining, single-cell and collective migration assays, bacterial culture and infection assays, and quantitative image analysis.

Profile

Strong background (M2 level) in cell biology and physics expected. Notions of microbiology and/or coding (Matlab/Python/ImageJ) will be a plus. The candidate should be curious, motivated and willing to work in a young, growing team with an interdisciplinary mindset.

References

Sankara et al, DOI: <https://doi.org/10.64898/2026.09.29.754870>

Sahnine et al, DOI: [10.1038/s44319-026-00843-z](https://doi.org/10.1038/s44319-026-00843-z)

Bonazzi et al, DOI: [10.1016/j.cell.2018.04.010](https://doi.org/10.1016/j.cell.2018.04.010)

Charles-Orszag et al, DOI: [10.1038/s41467-018-06948-x](https://doi.org/10.1038/s41467-018-06948-x)

Please send a CV and a letter summarizing previous work experience and research interests to Daria Bonazzi (daria.bonazzi@ijm.fr)