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Ecole Polytechnique
Room PC44

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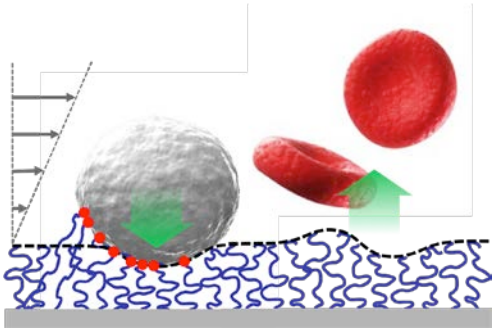
Regulating adhesion of blood cells to the vessel wall (with a bit of optics)



Blood cell / vessel wall interactions are critical both for the flow of red blood cells, and for the control of white blood cell adhesion to the walls (e.g. at a site of inflammation). However, the biochemical and mechanical cues governing their tight regulation are still poorly understood, in particular because of the challenge of non-invasive investigation of cell-wall short-range interactions under flow in a complex environment.

Using a home-built platform combining advanced biochemical surface functionalization, microfluidics and high-speed interferometric imaging, we have investigated experimentally the role of the softness of the vessel wall outer layer in the regulation of blood cell homing under flow. This brush, named glycocalyx and mainly composed of polysaccharides, is both thick (up to 1µm) and extremely soft (down to a few Pa in compression modulus). In this presentation, I will illustrate with experimental data and modelling how the glycocalyx acts as a gatekeeper for the adhesion to the blood vessel wall, and discuss the importance of soft adhesion in biology and its underlying soft matter concepts.

Some references

- Davies, Baranova, El Amri, Coche-Guérente, Verdier, Bureau, Richter, Débarre, An integrated assay to probe endothelial glycocalyx-blood cell interactions under flow in mechanically and biochemically well-defined environments, Matrix Biol. (2019) https://doi.org/10.1016/j.matbio.2018.12.002
- Davies, Débarre, El Amri, Verdier, Richter, Bureau, Elastohydrodynamic lift at a soft wall, Phys Rev Lett (2018). https://doi.org/10.1103/PhysRevLett.120.198001
- Ventalon , Kirichuk , Navon , Chastagnier , Heux , Richter , Bureau , Débarre, Optical Sectioning for Reflection Interference Microscopy: Quantitative Imaging at Soft Interfaces, Langmuir (2025) https://dx.doi.org/10.1021/acs.langmuir.5c00852