Modelling of the behaviour of cell-wall interface during the rolling of a single cell: a probabilistic approach

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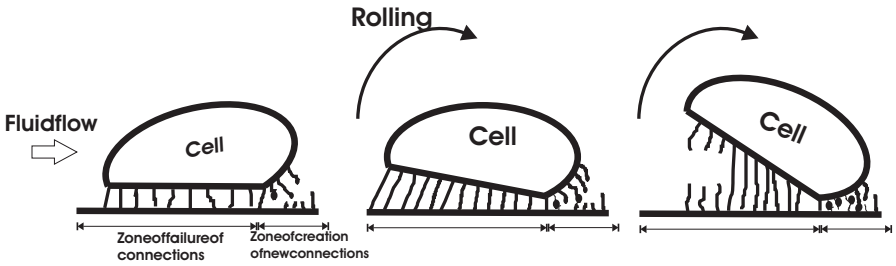
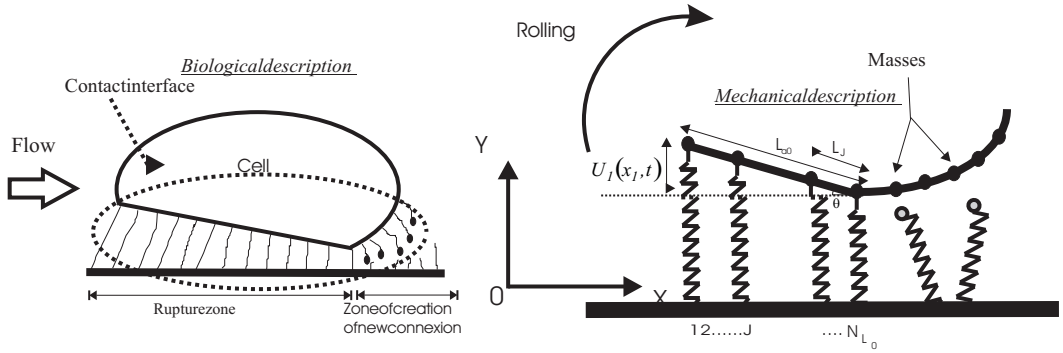
Summary

Rolling is an important manifestation of biological cell adhesion, especially for the leukocyte cell in the immune process. It combines several phenomena and interaction mechanisms such the affinity, the junction and failure between the adhesion molecules and the active deformation of the cell during the motility.



The focus here is the mechanical description of the kinetic of adhesion of a single cell in terms of the failure and creation of connections during the rolling; the mechanical and physical interactions occurring at the cell-wall interface are modeled as stochastic phenomena. A 2D model is set up, which describes the behavior of the contact zone between the cell and the extra cellular wall. The interfacial zone is assimilated to two rigid and rectilinear beams linked by elastic springs and subjected to the fluid flow and interaction forces, namely Van der Waals (attractive) and electrostatic (repulsive) forces. Numerical simulations emphasize the rolling phenomenon and the kinetics of creation and rupture of the ligands-receptors connections. A first insight into the interaction of the interface behavior with the cell (modeled as a shell) will be given.



Biological and mechanical description of the contact interface