A bio-mechanical model to explore the influence of the cell-matrix interactions as a key factor for cell motility

Nicolas Louviaux*[1]

[1]Biologie Computationnelle et Modélisation – U. Grenoble Alpes, Grenoble INP, TIMC-IMAG CNRS UMR 5525, 38000 Grenoble, France. – France

Abstract

Cell motility is the ability of cells to move spontaneously. It is often triggered by factors like chemical gradients (chemotaxis) or surface topography (durotaxis). It involves intracellular factors such as regulatory pathways and cytoskeletal structure, as well as extracellular factors like cell-cell and cell-environment interactions. Recent research, especially using traction force microscopy, focuses on how cells interact with and exert forces on the matrix during migration, which is crucial for understanding cancer invasion and tissue repair. However, the large gap between in-vitro and in-vivo conditions complicates studying these forces. This work presents a biomechanical model of a single cell on a deformable 2D substrate, simulating cell-matrix interactions through focal adhesions. The model explores different cell migration behaviors and compares them to experimental data. It also simulates durotaxis and biased migration on patterned substrates, offering insights into cell behavior and biological hypotheses.

*Speaker