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Mathematical modeling and simulation of the cell envelop, an active and adaptable biological interface

The cell envelop is an active and adaptable interface that plays a fundamental role in many biological events. To name a few, it determines cell shape and mechanics, controls the way cells adhere to each other, drives cell division and motility, and controls the structure and remodeling of multicellular tissues. Fundamental mechanical and chemical determinants of its biological function can be described with mathematical models involving partial differential equations on curved surfaces coupled with the geometric evolution laws for those surfaces. In this talk, I will describe instances of such models coupling chemistry, elasticity, hydrodynamics and active force generation, their numerical discretization, and how they can be used to connect with experiments and understand various phenomena in cell mechanobiology.