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The role of fluctuation theorems in biological adhesion

The catch-slip bond mechanism are bonds between ligands and receptors, that shows a counterintuitive effect. At low forces the bond lifetime increase until a maximum value, wich is called the catch bond; after the maximun the bond lifetime decrease as describe the Bell's theory of adhesion(Bell, 1978). In biology this effect can be observed in many ligand-receptor interactions such as Escherichia coli adhesion, FimH and P-L selectins expressed in leukocytes, actin-myosin interaction, or in integrins. But also this effect can be useful in order to develop new nanotechnological applications. From the development of the fluctuations theorems during the late 90's. These theorems had shown be very usefull in order to describe the behavior of small systems in biology, such as folding/unfolding cooperative effects. This systems operates away from equilibrium, where the fluctuations induce transitions between steady states. In this work we apply the Crook's fluctuation theorem in order to derive an expression for the bond lifetime, as a function of the applied elastic energy. The propossed model it is validated with other published works.