

Energy and information flows transduce free energy in biomolecular machines

David Sivak¹, Matthew Leighton^{1,2}, Jannik Ehrich^{1,3}

¹Simon Fraser University, Canada, ²Yale University, United States, ³Deutsche Bahn, Germany

In all living things, nanoscale molecular machines transduce free energy between different forms. Unlike their human-scale counterparts, these microscopic machines are characterized by stochastic fluctuations, overdamped dynamics, and soft components, and they operate far from thermodynamic equilibrium. Moreover, information is a relevant free-energy resource for them, leading to new modes of operation that are akin to Maxwell's demon. In this talk I will discuss our recent work in nonequilibrium thermodynamics studying how biomolecular machines internally transduce free energy, how the internal flows of energy and information constrain their external performance of biologically vital functions, and the surprising scale of these flows in naturally evolved machines.