Molecular machines and the thermodynamic cost of nostalgia.

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Molecular scale machines not only manipulate energy and matter at the nanoscale, they must also manipulate information. As a consequence, theres a tradeoff between thermodynamic efficiency, memory and prediction. A prodigious memory allows more accurate prediction of the future, which can be exploited to reduce dissipation. But the persistence of memory is a liability, since information erasure leads to increased dissipation. A thermodynamically optimal machine must balance memory versus prediction by minimizing its nostalgia, the useless information about the past. [1]

[1] Thermodynamics of prediction, Susanne Still, David A. Sivak, Anthony J. Bell and Gavin E. Crooks, Phys. Rev. Lett., 109, 120604 (2012)