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Novel effects of chain flexibility, external force, and background stochasticity on polymer translocation[1]

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The polymer translocation through membranes and the polymer crossing over activation barriers in general, are ubiquitous in cell biology and biotechnological applications. Because they are interconnected flexible systems, polymers in translocation incur entropic barriers but can thermally surmount them with unusual sensitivity to background biases. In the presence of non-equilibrium noises characteristic of living environments, the translocation can speed up much when resonant activation occurs. As a related issue, I will also discuss the problem of polymer surmounting a potential barrier, where the chain flexibility enhances the crossing. Furthermore, when the chain flexibility leads to conformational changes, the crossing rate can be even more dramatically increased. This conformational flexibility and variability enhance the stochastic resonance, where the chain crossing dynamics at an optimal temperature and chain length is maximally coherent and resonant to a minute periodic force. Utilizing the self-organizing behaviors mentioned above, we may learn about bio-molecular machinery of living as well as clever means of manipulating it.

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