Seminar/Talk

Energetic optimization during cell division

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Living systems are driven far from thermodynamic equilibrium through the continuous consumption of ambient energy. This energy is invested in the formation of complex, internal macromolecular structures and diverse spatial and temporal patterns in chemical and mechanical activities, which in turn orchestrate cell phenotypes and behaviors. This self-organization is a result of a system's tendency to maximize entropy production while maintaining order internally. However, a system that maximally dissipates energy can achieve high levels of organization and complexity, although this comes at the cost of low thermodynamic efficiency. Despite decades of research, little is known regarding the energetic principles and optimization strategies that constrain the dissipation of energy arbitrarily far from thermodynamic equilibrium. In this seminar, we explore energetic optimization, in studying the assembly of the cytokinetic ring, a complex structure that is an essential component of cellular reproduction and a defining aspect of living systems. Using the Xenopus Oocyte as a model system, we measure the production of entropy, as the cell approaches ring assembly and its first cell division. We demonstrate that en route to division, the production of entropy is maximized, but insofar as the overall system is bounded by energetic efficiency, and its internal chemical and mechanical activities are subject to constraints of Onsager Reciprocity. Thus, in living systems, multiple energetic parameters are optimized simultaneously to promote and sustain life.

Monday, July 14, 2025 10:45am - 11:30am

Sunstone Bldg / Ground floor / Big Seminar Room B / 63 seats (I23.EG.102)

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