

NORTHWESTERN INSTITUTE ON COMPLEX SYSTEMS PRESENTS

Wednesdays

@NICO

Phenomenological Systems-Level Theory of the Metabolism of Escherichia Coli



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12:00 – 1:00 PM

Chambers Hall, 600 Foster Street, Lower Level Classroom

The metabolism of a number of organisms has been reconstructed from annotated genome sequences. Studies of constraint-based in silico models have shown that metabolic states are the result of the optimization of a biological function, generally growth, acquired through evolution. The in silico models are also able to make accurate predictions of cellular growth. Despite these advances, we still lack a systems-level mathematical theory that is able to predict bacterial growth in arbitrary growing media and that is easily generalizable. Here, we develop a phenomenological theory that describes the relationship between input (nutrients) and output (growth) for the metabolism of Escherichia coli and test it against in silico predictions. Our theory suggests that, to maximize growth, the metabolism of E. coli effectively distributes nutrient uptake fluxes equitably among pathways that result in synergistic interactions with other nutrients. Additionally, our model provides a natural classification of nutrients into groups with different impacts on growth and opens the door to predicting the growth rate of any microbe with the need for only a few experiments.

NICO Coffee Hour will follow for questions, networking, and collaboration.

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