Abstract Submitted
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A Minimal Model of the E. Coli Bacterium in Exponential Phase Growth[1] ARIJIT MAITRA, KEN DILL, Stony Brook University — We study the fundamental process of exponential cell growth in the E. Coli bacterium under conditions of extracellular glucose limitations using a minimalistic reaction framework by accounting for energy metabolism and protein synthesis. The cell model has three nodes: ATP, the ribosomal and the non-ribosomal proteins. Their interdependencies and dynamics are wrapped in a system of ordinary differential equations. The formulations of their interactive fluxes capture the essence of cellular physiology under conditions of growth. We solve the model numerically for different glucose concentrations, and, where possible, explore the cell states analytically under steady state conditions. We verify the model predictions with available experimental data. The model lets us quantify the coupling between energy generation and biomass growth. An implication of this model is that it provides a layout to compute the fitness landscape in terms of the parameters of the cells, such as the protein translation rates, to make hypotheses about possible routes for cellular evolution under glucose limitation.

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