Abstract Submitted
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Growth behaviors of bacteria reveal the evolutionary significance of energy-efficiency[1] ARIJIT MAITRA, KEN DILL, Stony Brook University — Microorganisms have evolved a mosaic of gene expression changes to adapt their growth behaviors to changing environmental conditions. The subset of genes coding for the protein translation machineries, the ribosomes, however display robust linear activities with growth rates. Such patterns are considered to be the source of growth itself. There is another robust growth law, observed by Monod in the 1940s, in which bacteria are able to scale their growth with food concentration before plateauing off to a constant value. To interlink these observed growth laws we derive an analytical network model that leverages metabolic data to capture how the cell manages its exchange of energy to support costly gene expression. The model explores the limits of energy allocation for function and reveals evolutionary principles. Among others, we find, in glucose medium the fastest growing *E. coli* operate close to their maximum energy-efficiency. Optimization of energy efficiency provides a quantitative limit to how much energy is allocated for protein synthesis and it is determined by evolutionarily selected structural and biophysical constants. We conclude that energy efficiency has played a key role in bacterial evolution.

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