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Dynamic response of gene regulatory networks: A case study of heat shock regulation in Escherichia coli PRADEEP KUMAR, VENKATA KRISHNAMURTHI, SUDIP NEPAL, KHANH NGUYEN, Department of Physics, University of Arkansas Fayetteville AR 72701 — Temporal regulation of gene expression plays important role in cellular responses to external perturbations. Gene regulatory pathways ensure that cells are able to respond to temporal environmental changes by regulating the production of various proteins in a time-dependent manner. We have experimentally and computationally studied the dynamic response of gene regulatory network underlying the heat shock regulation in Escherichia coli. Specifically, we measure the dynamics of promoter activities of two key elements in the pathway–(i) heat shock sigma factor rpoH and (ii) dnaJ/K with oscillatory temperature shocks of various frequencies. Our results suggest that the dynamic response of heat shock regulation is optimized for a wide range of temporal variations in temperature.

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