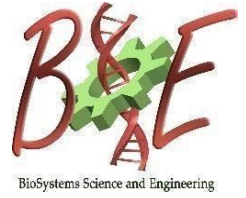




Indian Institute of Science
Centre for BioSystems Science and Engineering
BSSE Annual Work Presentation
9th March 2020 (Monday), 4:00 PM, MRDG Seminar Hall, 1st floor,
Biological Sciences Building



Heterogeneity in the Arabinose Inducible Gene Expression in Bacteria



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ABSTRACT

Isogenic microbial cells in homogeneous environments can display substantial phenotypic variation. Such underlying heterogeneity has been proposed to lead to phenomenon such as bacterial drug tolerance and persistence, a precursor state to antimicrobial resistance (Levin-Reisman et.al, Windels et al). We explore underlying heterogeneity in a well-characterized inducible gene expression system in bacteria, the Arabinose operon (Guzman, LM. et.al). To characterize such heterogeneity and understand their underlying cause, we monitored a fast degrading(fd) version of GFP expression (Andersen, JB et.al) under the ara promoter in cells with constitutive AraE transporter expression using flow cytometry and fluorescence microscopy. Even in the absence of heterogeneity in import of the inducer, our results show the existence of a bimodal population of cells, arising from heterogeneous switching on of GFP production upon inducer addition. This heterogeneity persists in non-arabinose metabolizing cells as well as displays transitions between gene 'ON' and 'OFF' states under constant inducer levels within the life cycle of a single cell, possibly indicating an inherent heterogeneity in the promoter activation or global state of the cell itself. Using a simple mathematical model that invokes stochastic switching between gene transcriptional states, we are able to reconcile our observations.