SBHSE SEMINAR

School of Biological and Health Systems Engineering

Illuminating Bacterial Individuality

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https://asu.zoom.us/j/98112983378

Abstract

Single-cell measurements of mRNA copy numbers inform our understanding of stochastic gene expression, but these measurements coarse-grain over the individual copies of the gene, where transcription and its regulation take place stochastically. We recently combined single-molecule quantification of mRNA and gene loci to measure the transcriptional activity of an endogenous gene in individual *Escherichia coli* bacteria. When interpreted using a theoretical model for mRNA dynamics, the single-cell data allowed us to obtain the probabilistic rates of promoter switching, transcription initiation and elongation, mRNA release and degradation. Unexpectedly, we found that gene activity can be strongly coupled to the transcriptional state of another copy of the same gene present in the cell, and to the event of gene replication during the bacterial cell cycle. These gene-copy and cell-cycle correlations demonstrate the limits of mapping whole-cell mRNA numbers to the underlying stochastic gene activity and highlight the contribution of previously hidden variables to the observed population heterogeneity.

Bio Sketch

Professor Ido Golding received his Ph.D. in physics from Tel Aviv University (Israel) in 2001. Originally trained as a condensed matter theorist, he later spent five years learning the experimental arsenal of modern molecular biology as a Lewis Thomas Fellow at Princeton University. Prof. Golding joined the faculty of the Department of Physics at the University of Illinois at Urbana-Champaign in 2007. In 2019, he returned to the Department from Baylor College of Medicine, where he had been a Professor of Biochemistry and Molecular Biology. At Illinois, Golding is also an affiliate Professor of Microbiology and a member of the Center for the Physics of Living Cells.