

Abstract Submitted
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Gene Location and DNA Density Determine Transcription Factor Distributions in *E. coli*¹ THOMAS KUHLMAN, University of Illinois at Urbana Champaign, EDWARD COX, Princeton University — The diffusion coefficient of the prototypical transcription factor LacI within living *Escherichia coli* has been measured directly by in vivo tracking to be $D = 0.4 \mu\text{m}^2/\text{s}$. At this rate, simple models of diffusion lead to the expectation that LacI and other proteins will rapidly homogenize throughout the cell. We have tested this expectation of spatial homogeneity by single molecule visualization of LacI molecules non-specifically bound to DNA in fixed cells. Contrary to expectation, we find that the distribution depends on the spatial location of its encoding gene. We demonstrate that the spatial distribution of LacI is also determined by the local state of DNA compaction, and that *E. coli* can dynamically redistribute proteins by modifying the state of its nucleoid. Finally, we show that LacI inhomogeneity increases the strength with which targets located proximally to the LacI gene are regulated. We propose a model for intranucleoid diffusion which can reconcile these results with previous measurements of LacI diffusion.

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