

Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Constraints imposed by nonfunctional protein-protein interactions on gene expression and proteome size JINGSHAN ZHANG, Harvard University, SERGEI MASLOV, Brookhaven National Laboratory, EUGENE SHAKHNOVICH, Harvard University — Crowded intracellular environments present a challenge for proteins to form functional specific complexes while reducing nonfunctional interactions with promiscuous nonfunctional partners. Here we show how nonfunctional interactions limit the proteome diversity and the average concentration of co-expressed and co-localized proteins. We use yeast compartments to verify our hypothesis that the yeast proteome has evolved to operate closely to the upper limit of its size, while keeping individual protein concentrations sufficiently low to reduce nonfunctional interactions. These findings have implication for conceptual understanding of intracellular compartmentalization, multicellularity, and differentiation.

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Date submitted: 20 Nov 2008

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