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The role of time scales in extrinsic noise propagation SRIVIDYA IYER-BISWAS, Dept. of Physics, The Ohio State University, JUAN MANUEL PEDRAZA, Dept. of Systems Biology, Harvard Medical School, C. JAYAPRAKASH, Dept. of Physics, The Ohio State University — Cell-to cell variability in the number of proteins has been studied extensively experimentally. There are many sources of this stochastic variability or noise that can be classified as intrinsic, due to the stochasticity of chemical reactions and extrinsic, due to environmental differences. The different stages in the production of proteins in response to a stimulus, the signaling cascade before transcription, transcription, and translation are characterized by different time scales. We analyze how these time scales determine the effect of the reactions at each stage on different sources of noise. For example, even if intrinsic noise dominates the fluctuations in mRNA number, for typical degradation rates, extrinsic noise can dominate corresponding protein number fluctuations. Such results are important in determining the importance of intrinsic noise at earlier stages of a genetic network on the products of subsequent stages. We examine cases in which the dynamics of the extrinsic noise can lead to differences from cases in which extrinsic noise arises from static (in time) cell-to-cell variations. We will interpret the experiments of Pedraza et al*. in the light of these results. *J. M. Pedraza et al, Science 25 March 2005:Vol. 307. no. 5717, pp. 1965 - 1969.

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