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From Asymmetric Exclusion Processes to Protein Synthesis[1] JIAJIA DONG, BEATE SCHMITTMANN, ROYCE K.P. ZIA, Department of Physics, Virginia Tech — Protein production rates are clearly vital for all biological systems. Thus, there is considerable interest in understanding the origins of these rates, as well as in manipulating them, especially for physiological and pharmaceutical applications. Since some codons are "fast" and others "slow," we propose to exploit these differences and modify the production rate for any specific protein by replacing codons in the associated mRNA by their synonymous counterparts. As an illustration, we study a simple model of protein production: the one-dimensional driven lattice gas, also known as the totally asymmetric simple exclusion process (TASEP). We investigate systematically the effects on the overall current (the protein production rate) of having one or two slow/fast sites (i.e., codons) in an otherwise homogeneous lattice. The currents show a non-trivial dependence on the location of a single "defect" as well as on the separation between two defects. We discuss the implications for more realistic models of protein production.

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