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Noise and correlations in genes silenced by small RNA. TERENCE HWA, EREL LEVINE, Center for Theoretical Biological Physics, UCSD — Many small regulatory RNAs have been identified in prokaryotes and eukaryotes in recent years. In many cases, RNA regulation is found in critical pathways. These include stress response and quorum sensing pathways in bacteria, and cell differentiation and programmed cell death in eukaryotes. In many cases, regulation by small RNA is used in switching off a response program as long as it is not required, allowing for a fast switching on when necessary. Clearly, accidental execution of such a program may bare grave consequences on the cell, and should be avoided. Here we analyze a stochastic model for gene regulation by the most abundant class of small RNA in bacteria. This class of small RNAs acts by base pairing with target mRNAs, silencing its translation and actively promoting its degradation. Importantly, the small RNA molecule is not recycled. Our model suggests that genes silenced by sRNA exhibits smooth noise, as opposed to the bursty noise characteristic to genes repressed at the level of transcription, with coupling between intrinsic noise and global, extrinsic fluctuations. In addition, we investigate how noise propagates through the indirect coupling between different targets of the same sRNA. These features are discussed in the context of circuits exhibiting multi-stability, where protein bursts have strong implications on spontaneous switching.

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