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Transcription of ribosomal RNA: the role of antitermination of RNA polymerase[1] STEFAN KLUMPP, TERRY HWA, Center for Theoretical Biological Physics, UC San Diego — The genes encoding ribosomal RNA are transcribed at high rates of 1-2 transcripts per second. These high transcription rates are crucial to maintain the large concentration of ribosomes necessary in fast growing bacteria. To understand how transcription is regulated under these conditions, we developed a model for the traffic of transcribing RNA polymerases (RNAP). Our simulations show that the transcription rate is limited by the elongation stage of transcription rather than by transcript initiation. The maximal transcription rate is severly impaired by RNAP pausing with pause durations in the second range which is ubiquitous under single-molecule conditions. We propose that ribosomal antitermination reduces pauses and thereby increases the transcription rate. This idea is in quantitative agreement with the observed increase of the elongation rate due to antitermination and predicts a two-fold increase of the transcription rate. Antitermination must be highly efficient, since incomplete antitermination with only a few percent of non-antiterminated, i.e. slow, RNAPs completely abolishes its effect. This result suggests that rho-dependent termination may selectively terminate slow RNAPs.

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