

Research Highlights

Article

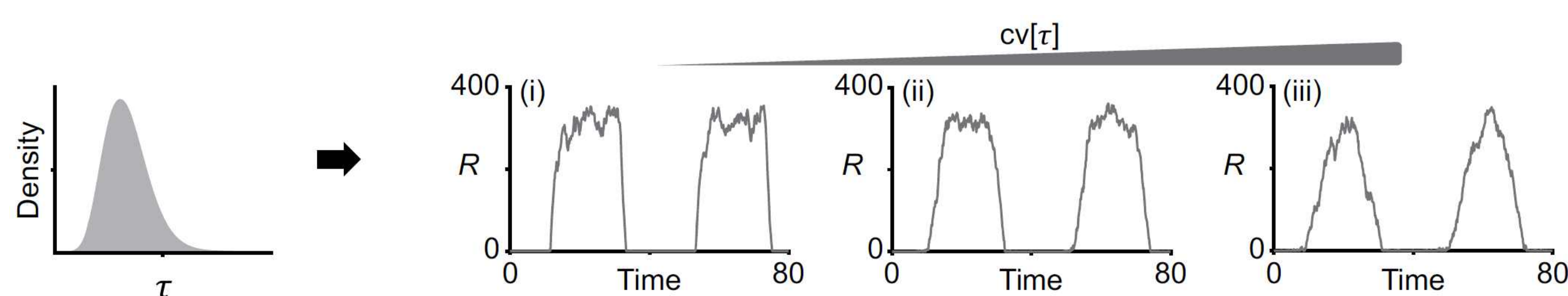
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Noisy Delay Denoises Biochemical Oscillators

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Contents

Genetic oscillations arise from delayed transcriptional negative feedback loops, where repressor proteins inhibit their own production following a time lag. This delay, shaped by stochastic processes like transcription, translocation, translation, and protein folding, is inherently stochastic. Traditionally, delay noise was thought to disrupt oscillatory dynamics by destabilizing repression timing and oscillation periods. However, our findings reveal that delay noise can unexpectedly enhance genetic oscillators. Specifically, moderate noise improves the signal-to-noise ratio and sharpens oscillation peaks without altering their period or amplitude. We demonstrate this denoising effect across various well-known genetic oscillators and use queueing theory to identify the universal principles underlying this phenomenon.



References