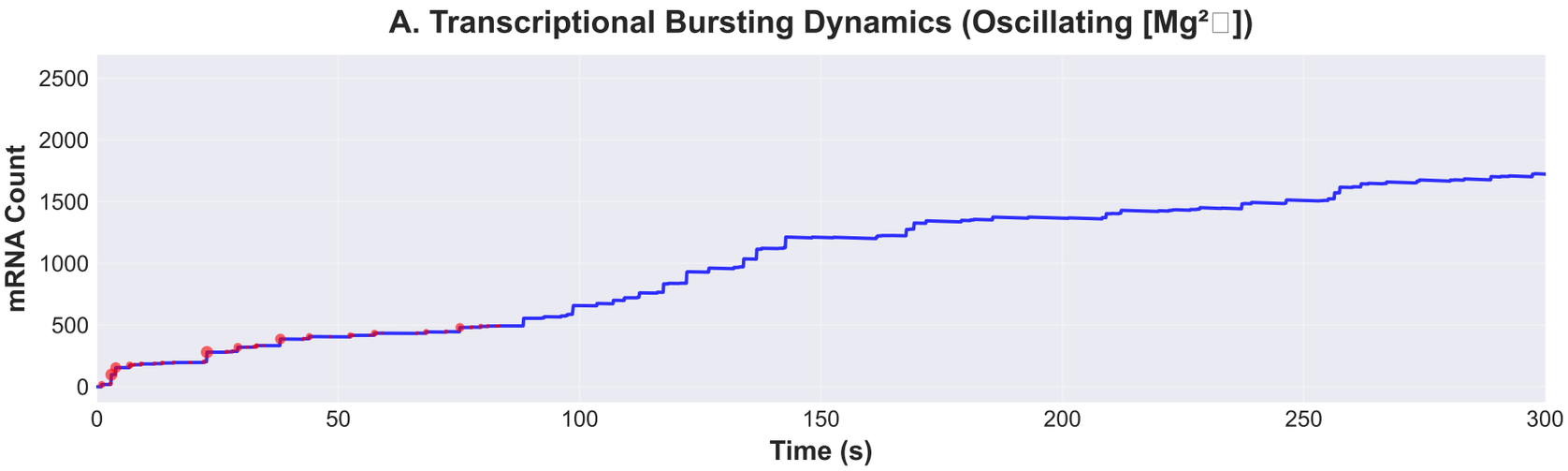
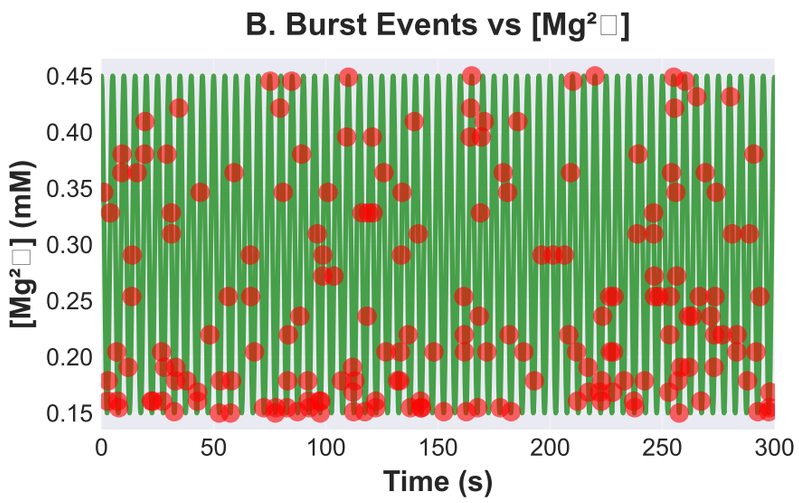
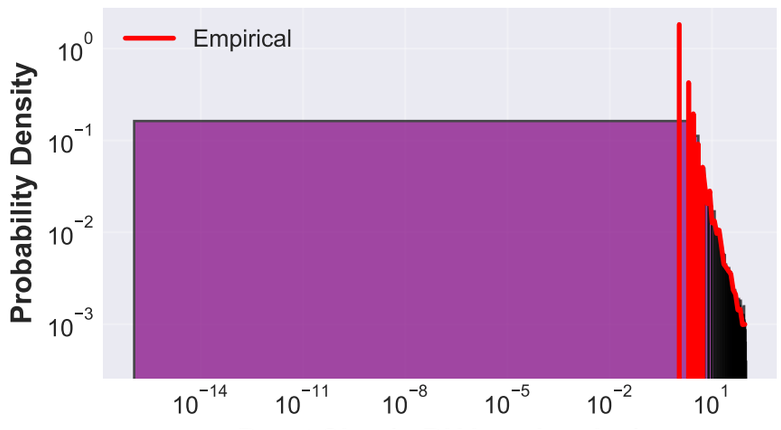
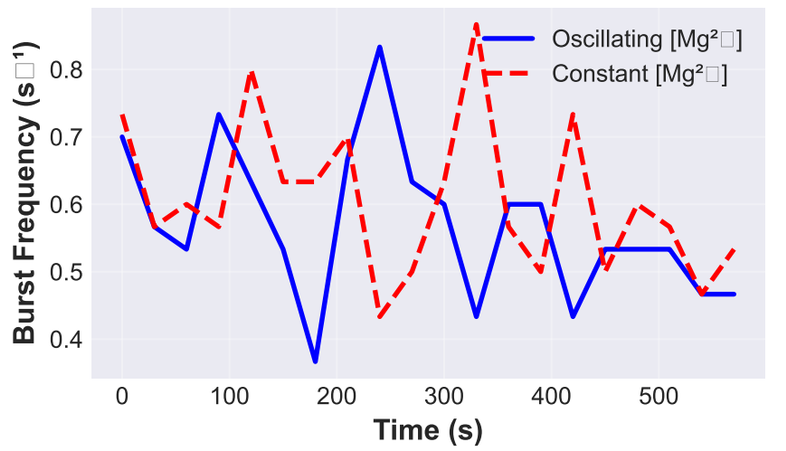
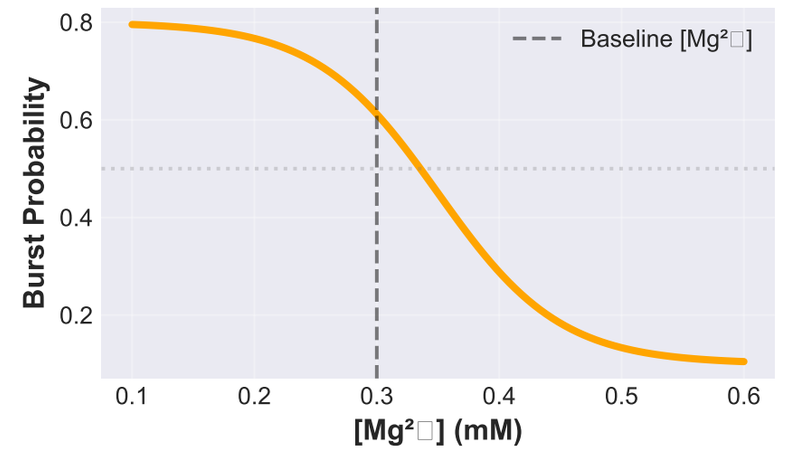
Transcriptional Bursting: Charge Avalanche Dynamics and Stochastic Gene Expression

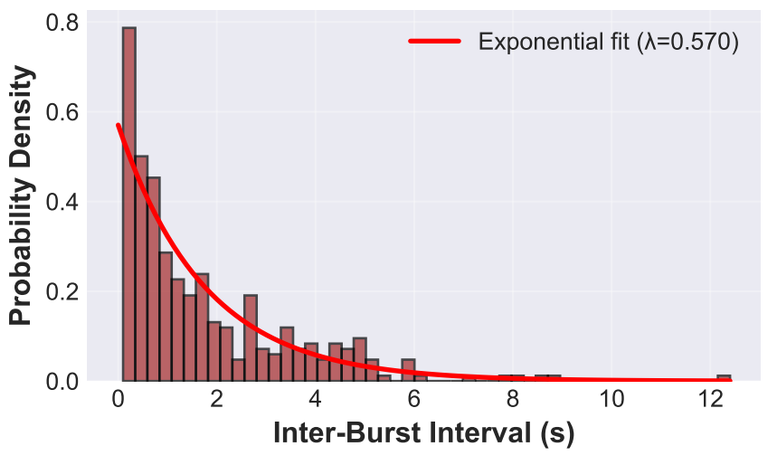


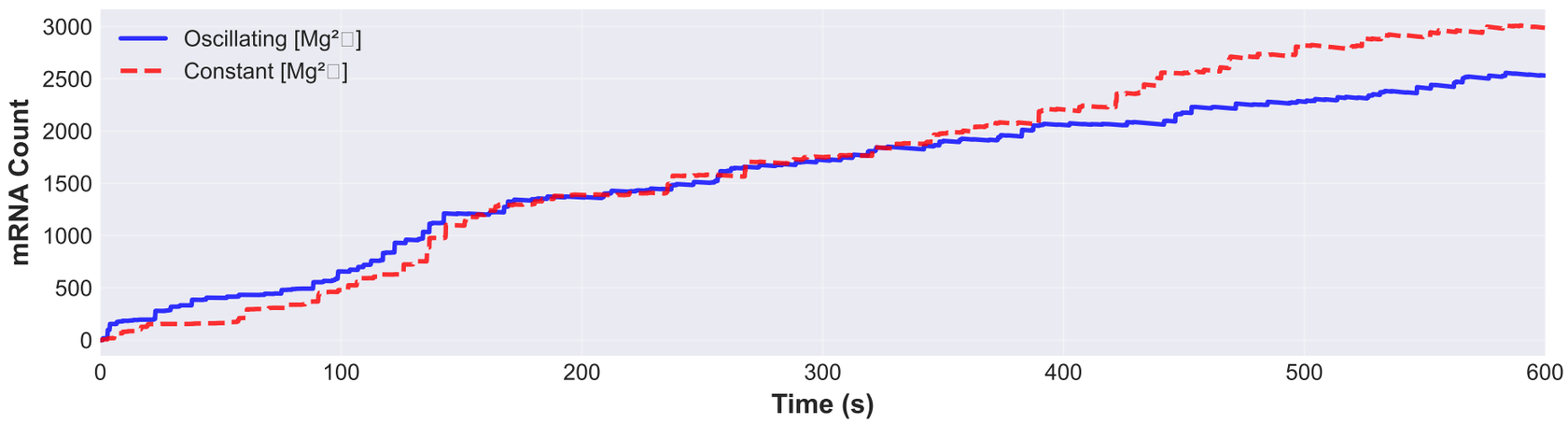


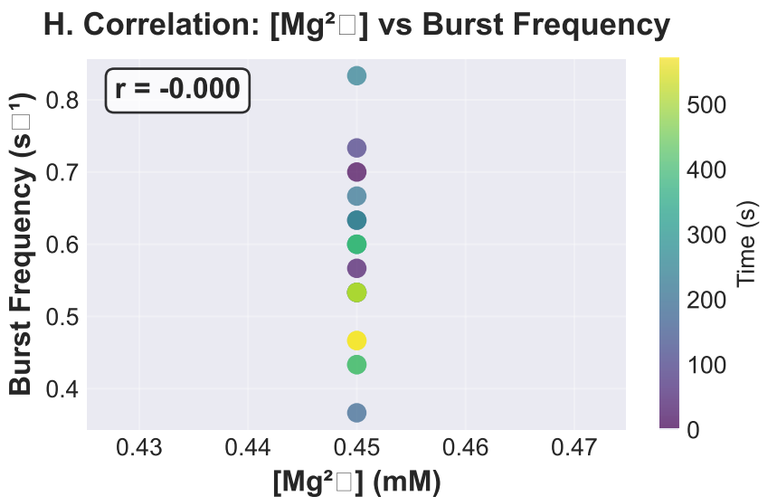


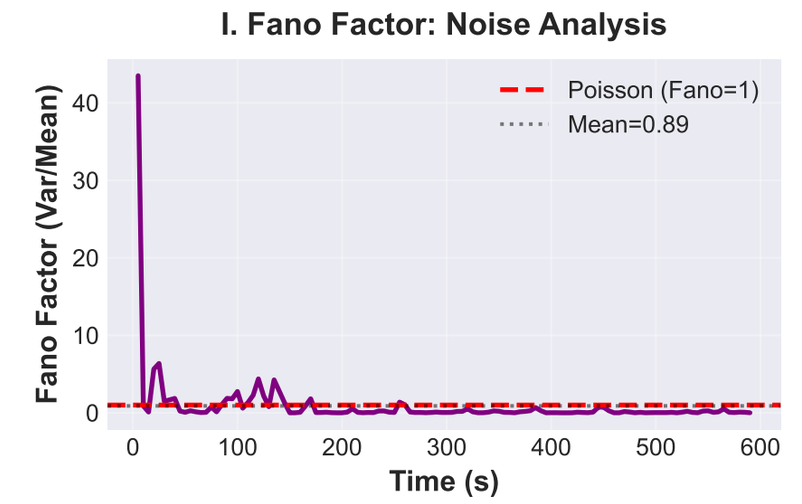










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BURSTING STATISTICS

Burst Events:
• Total (oscillating): 342
• Total (constant): 364
• Ratio: 0.94×

Burst Size:
• Mean: 10.9 mRNA
• Median: 3.0 mRNA
• Max: 99 mRNA
• Distribution: Power-law (α≈1.5)

Burst Timing:
• Mean interval: 1.75 s
• Frequency: 0.570 Hz

mRNA Levels:
• Mean (osc): 1581.6
• Mean (const): 1696.0
• Ratio: 0.93×

Noise:
• Fano factor: 0.89
• Super-Poissonian: False

Charge Mechanism:
• Low [Mg²⁺] → high P(burst)
• Stochastic fluctuations
• Avalanche dynamics
• Self-organized criticality
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