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Kinetic approach to biotechnology

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The fidelity of various biotechnologies, including PCR, genome editing, and RNAi, relies on the accurate hybridization between nucleic acids. The suppression of hybridization error would lead to error suppression and expand the applicability of these technologies. The conventional approach focuses on increasing the energetic stability of the correct hybridization. However, such energetic approach inherits limitations, including the lower bound for the error rate by the equilibrium value and the speed-fidelity trade-off. In this talk, we demonstrate two simple kinetic methodologies for the error suppression of DNA replication. First, we show that the blocker method used for PCR sculpts a kinetic barrier and suppresses errors without sacrificing the reaction efficiency. Second, we demonstrate multiplicative error suppression by multi-stage cascade replication.