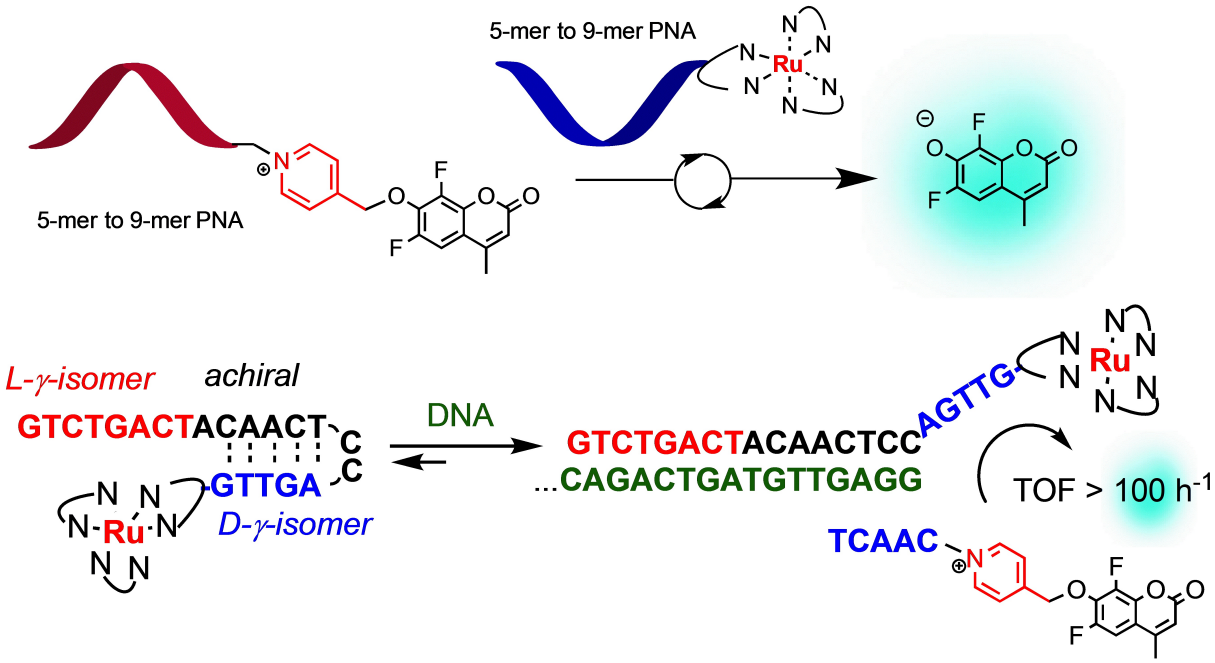
Critical Analysis of Rate Constants and Turnover Frequency in Nucleic Acid-Templated Reactions: Reaching Terminal Velocity

D. Chang[1], E. Lindberg[1], N. Winssinger[1]*

[1]University of Geneva

Templated chemical reactions have a long history dating back to prebiotic chemistry.[1] Based on the hybridization of probe to a template, reactions are promoted by the high effective concentrations. [2] [3] Nucleic acid templated chemical reactions have recently attracted significant attention for nucleic acid sensing and imaging. However, the rapid detection and high level of signal amplification are ongoing challenges for further application in biology. Herein, we have developed a new templated reaction with a pyridinium linker that is photocatalytically reduced with a ruthenium complex, which achieved the fastest rate reported to date for nucleic acid templated reactions. This reaction reaches the rate of notable enzymes. The catalytic efficiency of the systems (k_{cat} /K_M) is 10^5 $M^{-1}s^{-1}$. This fast templated reaction can be applied to the sequence specific detection of longer target sequences by embedding the template into a beacon architecture which is opened in the presence of the analyte.



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