

## Target-Triggered DNA Motors and their Applications to Biosensing

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**Abstract :** Inspired by endogenous protein motors, researchers have constructed various synthetic DNA motors based on the specificity and predictability of Watson-Crick base pairing. However, the application of DNA motors to signal amplification and biosensing is limited because of low mobility and difficulty in real-time monitoring of the walking process. The objective of our work was to construct a new type of DNA motor termed target-triggered DNA motors that can walk for hundreds of steps in response to a single target binding event. To improve the mobility and processivity of DNA motors, we used gold nanoparticles (AuNPs) as scaffolds to build high-density, three-dimensional tracks. Hundreds of track strands are conjugated to a single AuNP. To enable DNA motors to respond to specific protein and nucleic acid targets, we adapted the binding-induced DNA assembly into the design of the target-triggered DNA motors. In response to the binding of specific target molecules, DNA motors are activated to autonomously walk along AuNP, which is powered by a nicking endonuclease or DNAzyme-catalyzed cleavage of track strands. Each moving step restores the fluorescence of a dye molecule, enabling monitoring of the operation of DNA motors in real time. The motors can translate a single binding event into the generation of hundreds of oligonucleotides from a single nanoparticle. The motors have been applied to amplify the detection of proteins and nucleic acids in test tubes and live cells. The motors were able to detect low pM concentrations of specific protein and nucleic acid targets in homogeneous solutions without the need for separation. Target-triggered DNA motors are significant for broadening applications of DNA motors to molecular sensing, cell imaging, molecular interaction monitoring, and controlled delivery and release of therapeutics.

**Keywords :** biosensing, DNA motors, gold nanoparticles, signal amplification

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