DNA Zipper Based Devices

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BACKGROUND

DNA has been used to create a variety of molecular machines, including tweezers, sensors, walkers, and devices with properties mimicking logic-circuit operations. They are promising because of their small size, high binding specificity, ease of chemical synthesis, and commercial availability of inexpensive DNA oligonucleotides. The specificity with which DNA hybridizes holds the potential for designing a variety of DNA based diagnostic and therapeutic systems. The creation of synthetic nucleotides has allowed for the development of DNA helices with lower than normal binding interactions. This lower interaction energy can be exploited to separate the strands.

Previously reported DNA tweezers utilize single stranded DNA (fuel strand) overhangs, to drive the tweezer activity. These fuel strands are short and their overhangs are susceptible to non-specific binding and they often require additional DNA strands for its operation thus increasing their complexity and reducing the reliability.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed molecular zippers, methods to fabricate said zippers, and devices and applications enabled by them.

In an example embodiment, a DNA zipper has a strand containing synthetic bases that is displaced and replaced by a natural strand such that the double-strand separation does not require external energy. This simple zipper can be used to create a DNA nano-gate that can be reversibly opened and closed. Both the zipper and the gate were verified by gel electrophoresis and fluorescence measurements. The systems can be tailored to be sensitive to a range of physiologically relevant temperatures. These self-sustaining, modifiable nano-DNA zippers have broad applications from simple actuation and molecular recognition to a vehicle for molecular transport.

Other embodiments include DNA zipper based tweezers and springs. These devices can be activated under specific environmental conditions like temperature and pH. In the invention, the DNA zipper based tweezers do not necessarily rely on fuel strand overhangs and are more reliable than other types of DNA tweezers. They are also compact and modular so that they can be easily integrated with complex hierarchical DNA nanomachines. Their applications include *in vitro* diagnostics and drug delivery systems.

INTELLECTUAL PROPERTY INFO

This technology has a patent pending and is available for licensing and/or sponsorship.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20190010544	01/10/2019	2011-238
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OTHER INFORMATION

KEYWORDS

DNA based zippers, DNA tweezers, molecular machines, DNA machines, nanomachines

CATEGORIZED AS

- Nanotechnology
  - NanoBio

RELATED CASES

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