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Tunable and regenerative DNA zipper based spring PRESTON LANDON, ALEXANDER MO, ALAN GILLMAN, BRIAN MECKES, SRINIVASAN RAMACHANDRAN, RATNESH LAL, Department of Bioengineering and Department of Mechanical and Aerospace Engineering, University of California, San Diego, La Jolla, CA 92093, U.S.A. — We report a DNA zipper based actuator device termed 'DNA- spring' with tunable and repeated cycles of extension and contraction ability. DNA zipper is a double-stranded DNA system engineered to open upon its specific interaction with appropriately designed single strand DNA (ssDNA), opening of the zipper is driven by binding energy differences between the DNA strands. The zipper system is incorporated with defined modifications to function like a spring, capable of delivering approximately 9 pN force over a distance of approximately 13 nm, producing approximately 116 kJ/mol of work. Time-lapse fluorescence and fluorescent DNA gel electrophoresis analysis is utilized to evaluate and confirm the spring action. A second zipper incorporated into the spring provides the ability to couple/decouple to an object/substrate. Such devices would have wide application, including for conditionally triggered molecular delivery systems and as actuators in nano-devices. zippers.

Preston Landon
Dept of Bioengineering and Dept of Mechanical and
Aerospace Engineering, University of California, San Diego,
La Jolla, CA 92093, U.S.A.

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