Is a double-stranded DNA the simplest and fastest biomolecular rotary motor

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sMotivation and background

- Molecular rotary motors are essential for living system.
- For instance, F_0F_1-ATP synthase converts adenosine diphosphate (ADP) into adenosine triphosphate (ATP) by rotary motion.
- However, to replicate a molecular rotary motor requires an uneasy process.
- dsDNA may have a potential of becoming a molecular rotary motor because of its helix shape. Under a uniform field, the helix shape may have generated moment across the axis of dsDNA.
- The twist motion caused by the moment will be proportional to the voltage applied.
- We thought of this possibility and conducted a fluid mechanics theoretical analysis by deducing from the Navier-Stokes equations.

Experimental Setup

Theoretical approach

- Molecular motors are
- The properties of the actomyosin interaction have mainly been examined at two levels: skinned muscle fibers and
  single molecule measurements
- Using a DNA nanotube scaffold, we have engineered
  artificial myosin filaments with defined organization.
- Using a DNA nanotube-based O-shaped Myosin gliding assay (O-Myo), we continuously monitored interactions between small myosin ensembles and single actin filaments.
  - One step closer toward rigorous characterization of the lifetime of myosin motors.

dsDNA Modification

Questions

- In muscle, contraction and force generation emerge from
  the coordinated interactions between astronomical number
  of myosin motors and actin filaments.
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References