

# DNA origami-based nanostructures in stable motion

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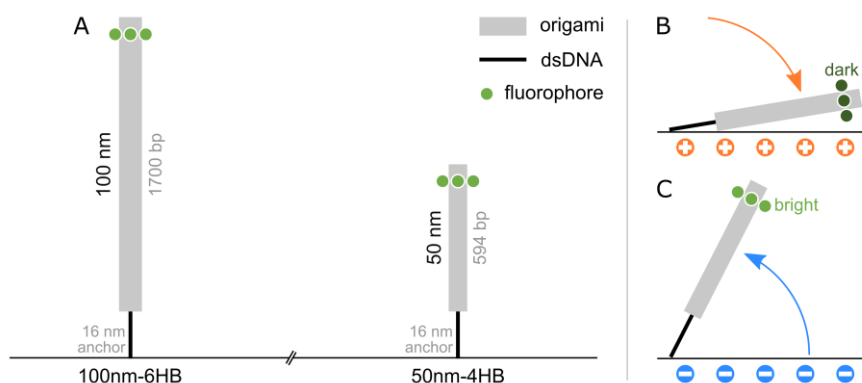
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We have studied the electrically induced switching behavior of different rod-like DNA origami nanolevers (Figure 1) [1-3] and compare that to the actuation of simply double-stranded DNA nanolevers. The measurements reveal a significantly stronger response of the DNA origami to switching of electrode potential, leading to a smaller potential change necessary to actuate the origami, and subsequently, to a long-term stable movement. The mechanical response time of a 100 nm long origami lever to an applied voltage step is less than 100  $\mu$ s, allowing for a highly dynamic control of the induced motion. Moreover, through voltage-assisted capture, the origamis can be immobilized directly from folding solution without purification, even in the presence of a large excess of staple strands. Dynamic measurements in buffer solutions with different  $Mg^{2+}$  content show that the levers do not disintegrate even at very low ion concentration and constant switching stress, and thus, provide stable actuation performance. The latter will pave the way for many new applications without largely restricting application-specific environments. In particular, using DNA origami with low concentrations of  $Mg^{2+}$  ions in solution qualifies them for a broad range of biomedical and biophysical applications.



**Figure 1:** (A) Schematic of the investigated origami attached to a gold electrode: 100 nm long six-helix bundle and 50 nm long four-helix bundle. (B, C) Electrically induced orientation switching of origami rods: When positive potentials are applied to the electrode, the rods are attracted to the electrode and the fluorescence emission from dyes attached to their top ends is quenched by the metal surface. When negative potentials are applied, the rods are repelled from the surface and the fluorescence emission is high.

## References

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