DNA Origami Nanocalipers as a Mesoscale Probe of Chromatin Fibers

Michael Darcy1, Jenny Le3, Kyle Crocker1, Yuchen Wang3, Ralf Bundschuh1,2, Carlos Castro2,3, Michael Poirier1,2

1 Department of Physics, The Ohio State University, 2 Interdisciplinary Biophysics Graduate Program, The Ohio State University, 3 Department of Mechanical and Aerospace Engineering - The Ohio State University

Single Molecule Biophysics

- By examining the dynamics of single molecules, we can piece apart complicated biological mechanisms
- The biophysical mechanisms of gene regulation are not yet well understood due to their scale and complexity
- We aim to develop new tools to probe these regulatory mechanisms

DNA Origami Nanotechnology

- Programmed self-assembly of a 7000-8000 nucleotide “scaffold” strand (single stranded DNA)
- Guided by ~200 shorter (30-50 nt) single-stranded “staples”
- Assembly of scaffold and staples by thermal gradient “folds” dynamic and static components

FUTURE WORK

GOAL: develop a device to probe site-specific chromatin dynamics at 10-100 nm length scales:

- (a) Single nucleosomes
- (b) Nucleosome Arrays
- (c) Site-specific within array

CONCLUSIONS

- We are able to faithfully monitor nanocaliper state by fluorescent reporter
- Nanocaliper dynamics are sensitive to both pivot location design and strut length
- Multiple opening and closing rates indicate potentially complicated dynamics

REFERENCES