

## SUPPORTING INFORMATION

### **Steric Communication between Dynamic Components on DNA nanodevices**

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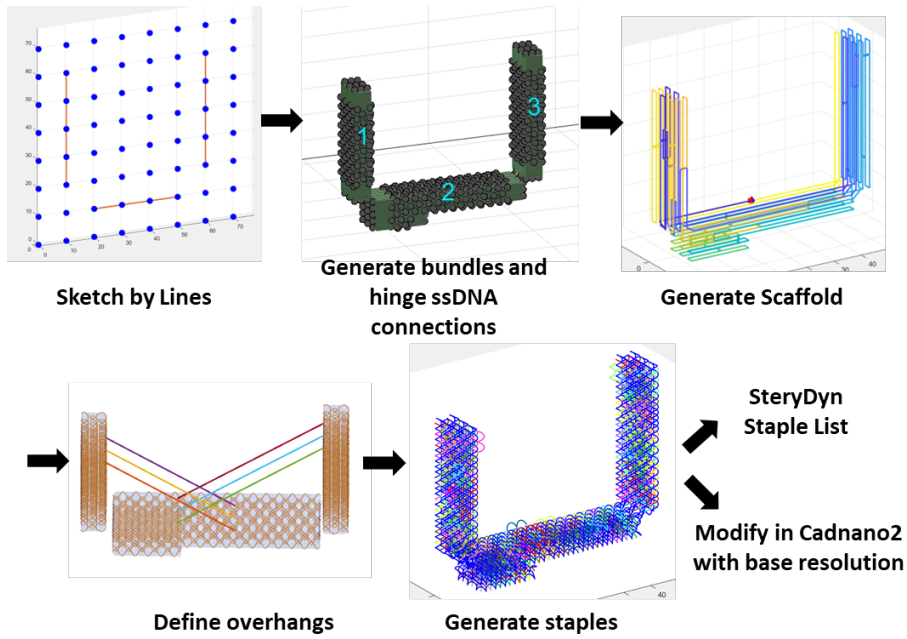
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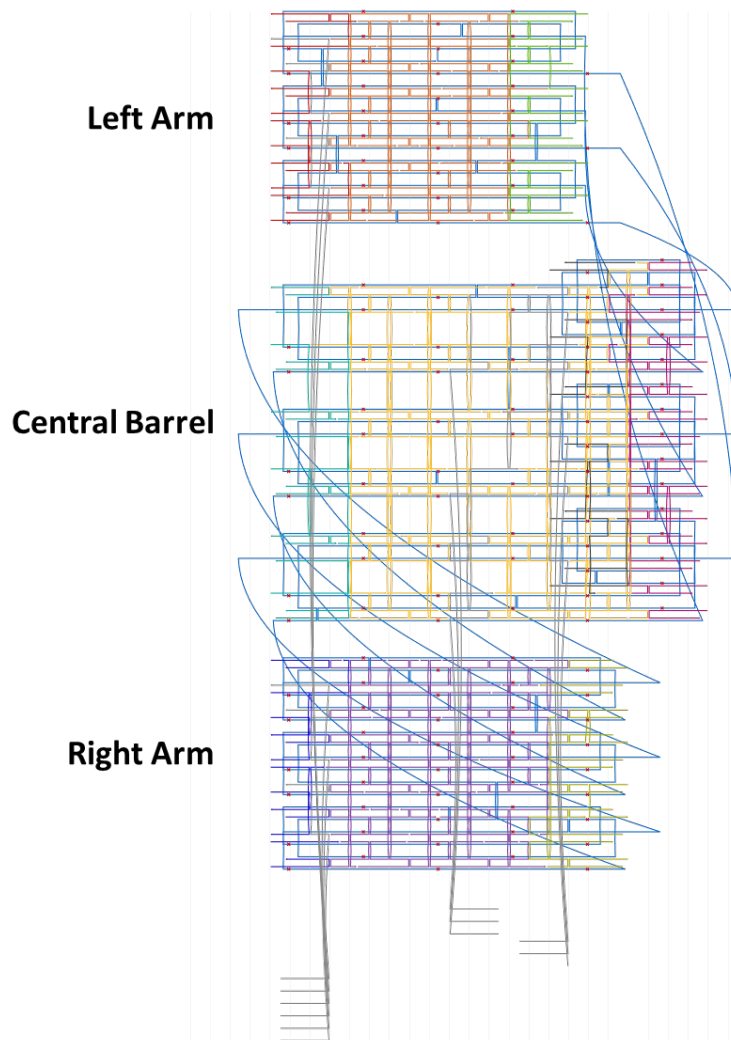
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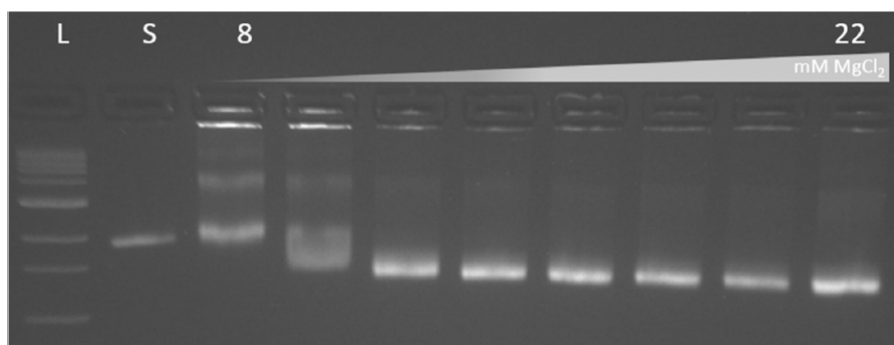
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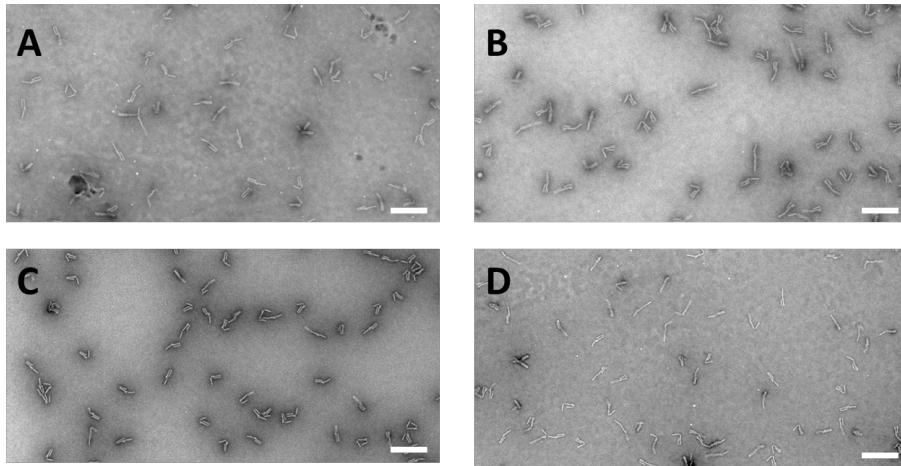
**Figure S1.** The baseline SteriDyn (free) design on MagicDNA



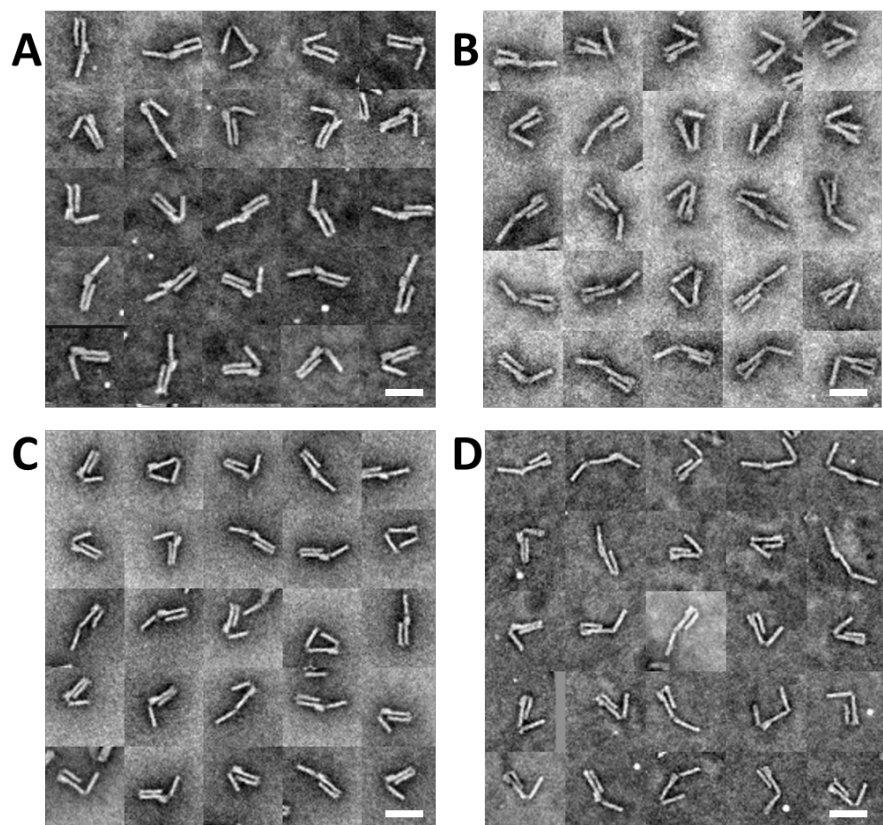
**Figure S2.** Cadnano Design Blueprint of Baseline SteriDyn (free).



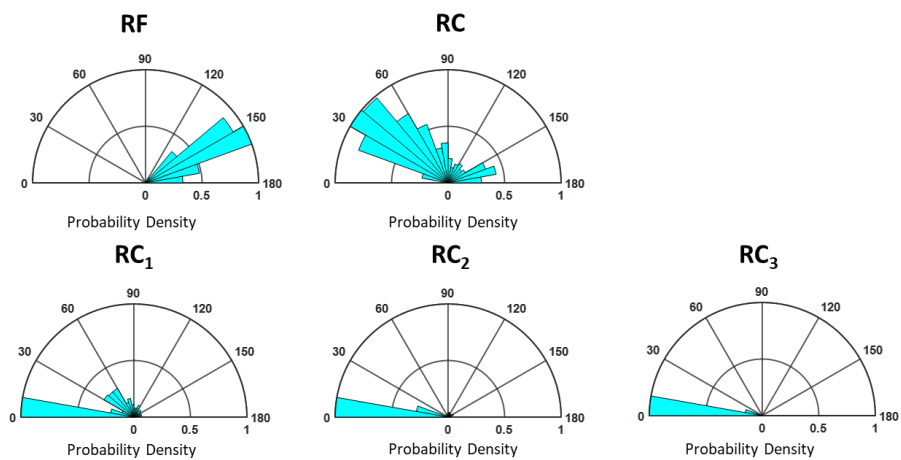
**Figure S3.** Gel electrophoresis of MgCl<sub>2</sub> titration for baseline SteriDyn folded with [8, 10, 12, 14, 16, 18, 20, 22] mM MgCl<sub>2</sub> concentration. L: 1kb Ladder, S: 8064 ssDNA scaffold.



**Figure S4.** Representative TEM images of (A) LC<sub>1</sub>|RC<sub>3</sub>, (B) LC<sub>3</sub>|RC<sub>1</sub>, (C) LC<sub>1</sub>|RC<sub>2</sub>, (D) LC<sub>2</sub>|RC<sub>1</sub>. (Scale bars = 150 nm).



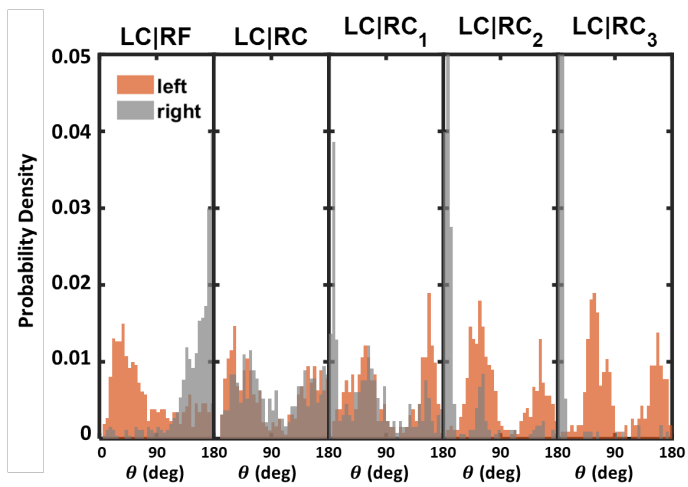
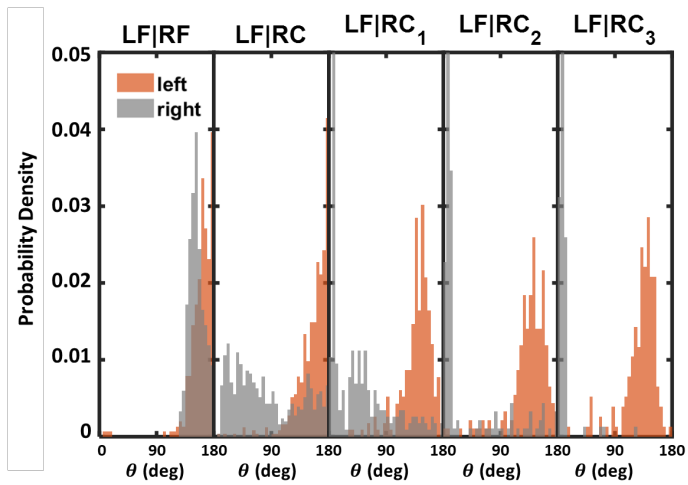
**Figure S5.** Sample TEM image galleries of (A) LC<sub>1</sub>|RC<sub>3</sub>, (B) LC<sub>3</sub>|RC<sub>1</sub>, (C) LC<sub>1</sub>|RC<sub>2</sub>, (D) LC<sub>2</sub>|RC<sub>1</sub>. (Scale bars = 50 nm).



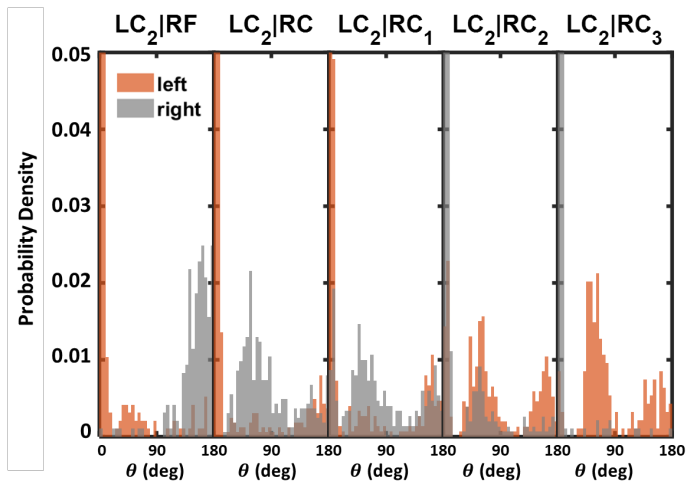
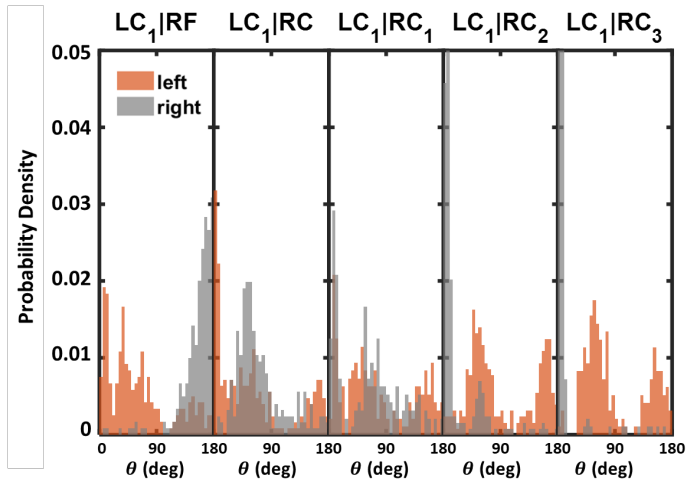
**Figure S6.** The right arm angular distribution plots with the left arm being in the free configuration. The sample size of RF, RC, RC<sub>1</sub>, RC<sub>2</sub>, RC<sub>3</sub> are 303, 511, 232, 185, 154.

Commented [CC1]: Give sample size numbers here like you do in the main figure.

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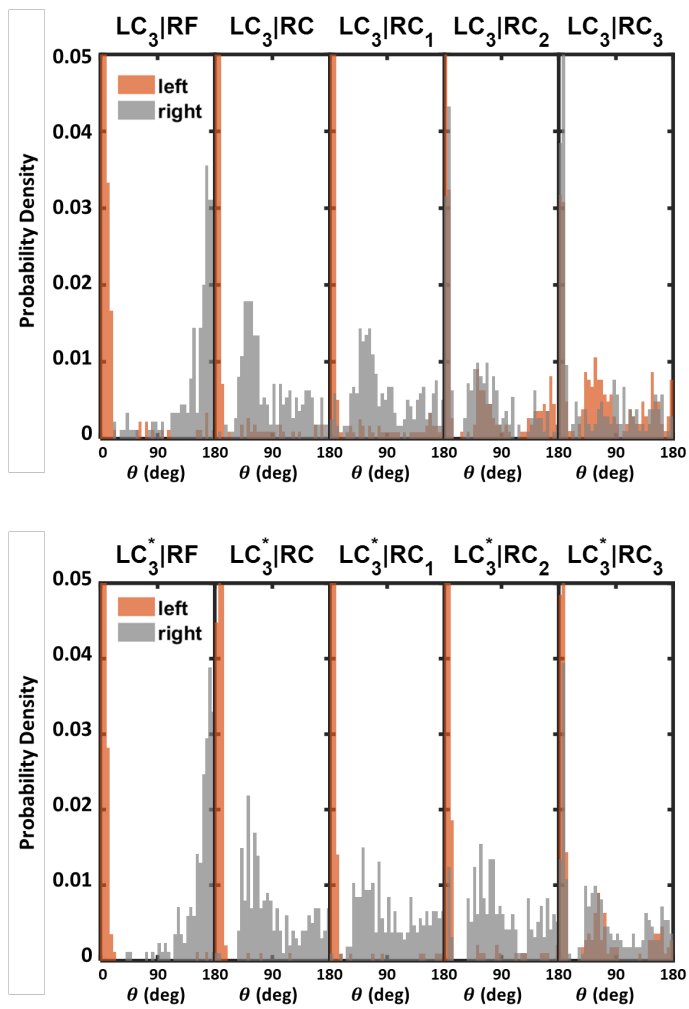
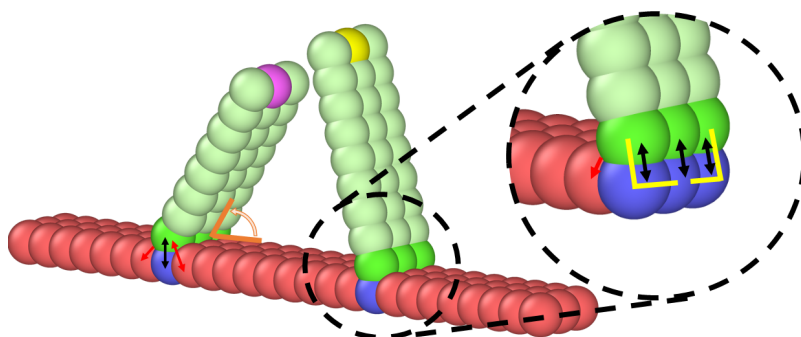
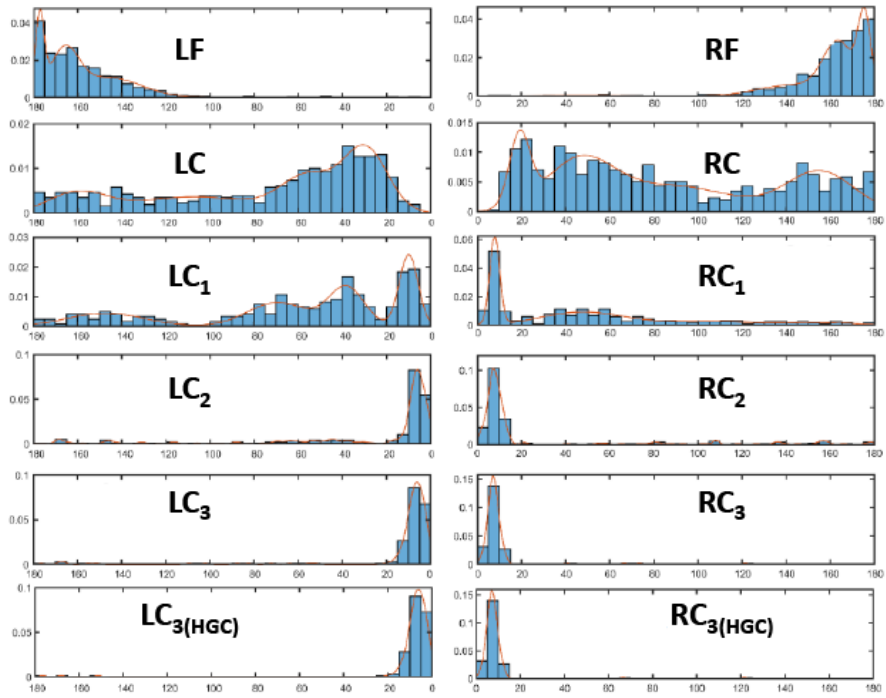


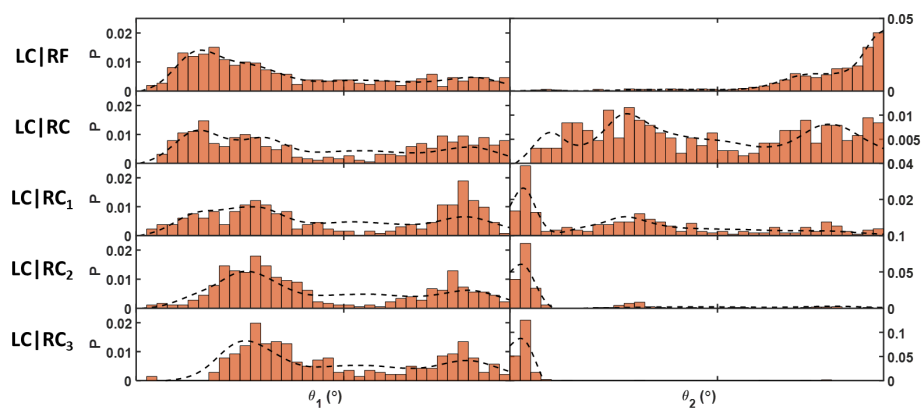
Figure S7. The angular distributions for all SteriDyn tested. Asterisk represents high GC conditions.



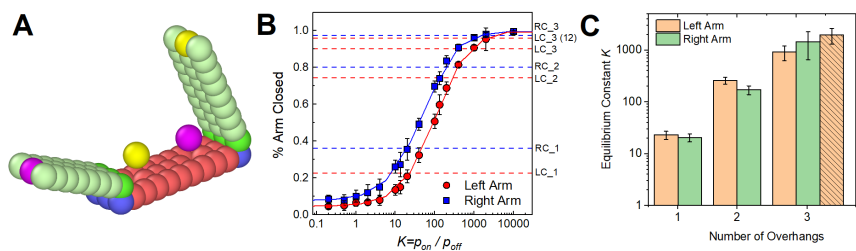
**Figure S8.** Schematic of the coarse-grained DNA origami device implemented in this work and detail of one hinge from our coarse-grained model. Arrows represent bonds that keep the base of the arms on a fixed position, and yellow lines represent the angle potentials that avoid rotation around their longitudinal axes. The stiffnesses of the bonds and angle potentials (of harmonic nature) are  $0.0178 \text{ eV/\AA}^2$  and  $10.7 \text{ eV/}^\circ^2$ , respectively, and the equilibrium lengths and angles are  $\sigma$  (black),  $\sqrt{2}\sigma$  (red) and  $90^\circ$  (yellow), respectively. The orange angle is determined between the arms, the pivot beads, and the axis of the platform. Orange angles are measured from the inside (counterclockwise for left arm, clockwise for right arm). In the rest of the manuscript, the regions of the platform placed to sterically forbid sampling of angles larger than  $180^\circ$  are omitted for simplicity.



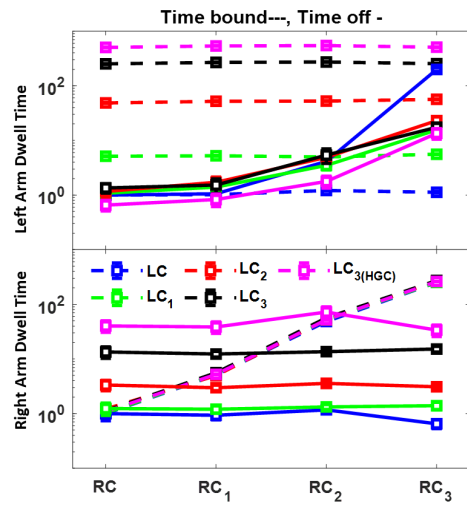
**Figure S9.** Experimental (histogram) and fitted (solid line) distributions  $P(\theta)$  for the left arm of a device with a fully open right arm (RF) and for the right arm of a device with a fully open left arm (LF).



**Figure S10.** Comparison between simulated (dashed line) and experimental (bar) angular distributions for Angular phase-space of the interacting arms.



**Figure S11. (A)** Schematic of the coarse-grained DNA origami device implemented in this work, including binding sites. Note that beads of the same color (yellow, purple) are capable of binding to each other. **(B)** Simulated percentages of closed arms for different unbinding probabilities (symbols), fitting to three-phase exponential decay functions with  $K$ -independent parameters (solid lines), and experimental values of the percentage of closed arms for each arm (dashed lines). 30 simulations were run for each parameter. **(C)** Fitted equilibrium constants  $K$  for arms with different numbers of overhangs (dashed bar is associated with  $LC_{3(HGC)}$ ). Note that adding an overhang increases  $K$  non-linearly (first addition by  $2.5 k_B T$ , second by  $1.5 k_B T$ ).



**Figure S12.** Simulation of SteriDyn dwell time for latching (bound) and unlatching(off). The dwell time are all normalized by LC|RC.

**Table S1** Sample Sizes in TEM Characterization

Structure Name	Total Sample Size, N
LF RF	303
LF RC	511
LF RC <sub>1</sub>	232
LF RC <sub>2</sub>	185
LF RC <sub>3</sub>	154
LC RF	521
LC RC	383
LC RC <sub>1</sub>	264
LC RC <sub>2</sub>	356
LC RC <sub>3</sub>	232
LC <sub>1</sub>  RF	240
LC <sub>1</sub>  RC	252
LC <sub>1</sub>  RC <sub>1</sub>	192
LC <sub>1</sub>  RC <sub>2</sub>	258
LC <sub>1</sub>  RC <sub>3</sub>	194
LC <sub>2</sub>  RF	193
LC <sub>2</sub>  RC	325
LC <sub>2</sub>  RC <sub>1</sub>	301
LC <sub>2</sub>  RC <sub>2</sub>	306
LC <sub>2</sub>  RC <sub>3</sub>	188
LC <sub>3</sub>  RF	180
LC <sub>3</sub>  RC	224
LC <sub>3</sub>  RC <sub>1</sub>	237
LC <sub>3</sub>  RC <sub>2</sub>	222
LC <sub>3</sub>  RC <sub>3</sub>	208
LC <sub>3(HGC)</sub>  RF	170
LC <sub>3(HGC)</sub>  RC	201
LC <sub>3(HGC)</sub>  RC <sub>1</sub>	213
LC <sub>3(HGC)</sub>  RC <sub>2</sub>	194
LC <sub>3(HGC)</sub>  RC <sub>3(HGC)</sub>	223
LF RC <sub>3(HGC)</sub>	154
LC RC <sub>3(HGC)</sub>	282
LC <sub>1</sub>  RC <sub>3(HGC)</sub>	131
LC <sub>2</sub>  RC <sub>3(HGC)</sub>	203



**Table S2.** Equilibrium constants used in our simulations.

Number of Overhangs	$K (p_{off})$
1	20 (0.005)
2	200 (0.0005)
3	1000 (0.0001)
3 (HGC)	2000 (0.00005)

**Table S3.** Baseline SteriDyn Staple List (color coding refers to Cadnano design)

Staple Names	Sequence
Center Barrel - Right End - 1	TTTTTATGTTTACCAGTCGCGGTTGTGTACATCGACATTTTT
Center Barrel - Right End - 2	TTTTTTAAAAAATCGTCAGCGTGTTTTTT
Center Barrel - Right End - 3	GCTGAGGCTTGCAAGGAGTTAAACGTACAGCGCCTTTTT
Center Barrel - Right End - 4	TTTTTCTTTCGCACTCAATGTAGAAC GCCGGATCGGCGAAAGGCCGAGCGACAGAATCAAGTTTG CCTTAGCGTC
Center Barrel - Right End - 5	TTTTTGCTGGTCTGGGTCCAGACGACTTTTT
Center Barrel - Right End - 6	GTACCTTTAATTGCTCCTTTTGTATTGCAGGCGTTTTT
Center Barrel - Right End - 7	TTTTTCGCTGAGAAGAGTGTAAATCTTCAGCAGCAACCGCA AGCCGGACTTCC
Center Barrel - Right End - 8	TAGTGTACAGCGGGATAAGAGCGACGATAAAAACCAAAT AGCGAGAGGCT
Center Barrel - Right End - 9	TTTTTGACAATAAACAACATGTTTCAGCTAATAAGGTAAACA A
Center Barrel - Right End - 10	AAACCAAGTACCGGATTAAGATTTTT
Center Barrel - Right End - 11	ACATAGCGATAGCTTACACTCATCGAGAACAGGAAAAACG CTCATGGAAATACCTACAT
Center Barrel - Center Strands - 1	GCCAACAGGCGGGGAAACAGCGCGTTTAC
Center Barrel - Center Strands - 2	GAAAGAGACGCAGAAACAGCGGAAACGATGTGGAGCCC CCTGCGATAGTAAGCTGAATA
Center Barrel - Center Strands - 3	GGCACCGCTTCAAATATTTAAACGTGCTCGTCAGATACAT AACGCCAAAAGGAATTA
Center Barrel - Center Strands - 4	AAGAGTTAAAATGTAACGCCGTTTCAGCATGAGATTTTTTC
Center Barrel - Center Strands - 5	CTCTTACGACAGTATCGGCCTCCAGTTTGAGCGGTCACGTT GGTGATCA
Center Barrel - Center Strands - 6	CATCGATAGCAGCACCGTATAGACTTACCTACCCCTTAGT CTCATAACGGA
Center Barrel - Center Strands - 7	CCGGAAACTCACGGAATTTTCAGAGGCTGATTGTCGTCGCTG GCAGCCTTCCATG
Center Barrel - Center Strands - 8	CCGTAAAAAAGCCGCGCAGTTGGCCGGAATTTGTGAGAG AATCAGTTTTTGCG
Center Barrel - Center Strands - 9	AAAGTTTCAAACCTTGTGAAGGGATAGCTCGTCACCAAACAG CAT
Center Barrel - Center Strands - 10	TTTTCGCACTCTGTTGGGAAGGGCGACATTTGGGAGG
Center Barrel - Center Strands - 11	ATTACCCGGTTGCTGTAATAGCAAACAAAAGCAATA

Center Barrel - Center Strands - 12	GGATCGTCACCCTCGTTGCGGTATGTGGAGGTGACG
Center Barrel - Center Strands - 13	GCTTTGAGGACTACTAATGCATAAACATTGCGAACGGGC
Center Barrel - Center Strands - 14	AAGTTTCCATTAATCATCAGTAATCGTTACAGACGATGAGA ATCGACGCTCAAGGC
Center Barrel - Center Strands - 15	TACAATAATCAGCAATTCTACATATAACTCGCAAGATACTTC TTGCGAGGGCGTTTTAGCG
Center Barrel - Center Strands - 16	ACGTGAATGCCATCCAGCAAATTTATCATTGCAACAAG
Center Barrel - Center Strands - 17	TCGTCCCGTTCCGGCAAACGCCTGGTGCCG
Center Barrel - Center Strands - 18	CCGTTGGTTTCTTACGGCCAGACGGCTACATTACCATTAGC AAGG
Center Barrel - Center Strands - 19	CATCATATGTACAATTTTGTGTAGCCAGGGGACGTCGGA
Center Barrel - Center Strands - 20	CAGAGTCATTTTTCGCGATGCGCCAGCCAAAATCATCCAAG AACCGCTGT
Center Barrel - Center Strands - 21	TATCATAACCCTCAGCAACGGATATCTCCGTGAAATTTCTGC TCATTTGCC
Center Barrel - Center Strands - 22	CGAGGCGCTGGTAAATACATTTTCGCAACACCTTTTTATGGT AATATCATTAC
Center Barrel - Center Strands - 23	GCAGCATAAAGTACCGACAAGCAGAACGGGGTATT
Center Barrel - Center Strands - 24	GTCAATAACCAGAGGCATTTTCGAGGTCCTGAAATC
Center Barrel - Center Strands - 25	TTGGAGTAGATTAACCTATATGAGTAGATATAGAAGGCTTAT CCGG
Center Barrel - Center Strands - 26	GCGAGCATATTTAACAACGCAATAAGAATAAACACCGGAA TCAT
Center Barrel - Center Strands - 27	CATAAAAGCCCCTGGTGTAGGGTTTTTTTCATGAATTAGAG
Center Barrel - Center Strands - 28	AGAGCTTACGGCAGCCGGGTAGCACATCGATGAAGGGT
Center Barrel - Center Strands - 29	TAAAGCACTTGCTGTAAATGTAAGGCGTTAAATTTA
Center Barrel - Center Strands - 30	ATTCCCAGCGCATGTAGCAACAAGAAGCTTAATGGTCCTGT TTAG
Center Barrel - Center Strands - 31	GAATACCGTCGGTGGTGCCACCGCCAGCACTGTTGGCCA CGGGAGCGAAAGTGAAAC
Center Barrel - Center Strands - 32	TTATCAACAATAGATAACCAGTAATGAGACTACGCAACCAG CTTAATTGAGCAACAC

Center Barrel - Center Strands - 33	CATCCTCAACATGTGGGTTATATTAGTTTGCATGTTTTAAAT ATGCAAC
Center Barrel - Center Strands - 34	AATTACTCTTAATTGAATCAAAGTTGATTCTGGAAGAGGA ATAC
Center Barrel - Center Strands - 35	AAAAGTTGAAATACCGACCGTTAAGAAGCTGATTAGT
Center Barrel - Center Strands - 36	GGCTGTCTTTCCCGTAGGAATCCAGAACAATATTACGCTT
Center Barrel - Center Strands - 37	CGAGCATCAAATCAGAAGAACTCAAATCTAGCTCAAAC CATTAGTGGGTAAATTT
Center Barrel - Center Strands - 38	CAAGCCGTTTTATTTTCATTTATCATTAGGTCTGAAAGA
Center Barrel - Center Strands - 39	TATTCGTGATAAACTGATGCAAGAATCGCCTGAAAAGGTG G
Center Barrel - Center Strands - 40	AACCTCCACCTAAATGCGAGAAATAAAGCCAATGA
Center Barrel - Left End (Indicator/inward) - 1	TTCTCCGTGGGAACAAACGGCGGATTTTT
Center Barrel - Left End (Indicator/inward) - 2	TTTTTATCGTAACCGTGCATCTGCAGG
Center Barrel - Left End (Indicator/inward) - 3	TTTTTTTGACCGTAATGGGATTTTTTATGACCGCAAGGC AAAGATTTTT
Center Barrel - Left End (Indicator/inward) - 4	TTTTTCATCCAATAATAGATGGGCGCTTTTT
Center Barrel - Left End (Indicator/inward) - 5	TTTTTATTAGCAAATCTAATAGTTCTACAAACAGTAGGGA GA
Center Barrel - Left End (Indicator/inward) - 6	AACCGTTCTAGCTGATAAATTTTTTT
Center Barrel - Left End (Indicator/inward) - 7	TTTTTTTTTGAGAGAAGTAGCATTAAATTTTT
Center Barrel - Left End (Indicator/inward) - 8	TATCAGTGTAGGTAAGAGAGAGGGTAGCTATTTTTT
Center Barrel - Left End (Indicator/inward) - 9	TTTTTAATGCCGTTCAAAGGGTGA
Center Barrel - Left End (Indicator/outward) - 1	TTTTTAGTAACAACCCGTAGGAACGCCATCAAAAATTTTTT
Center Barrel - Left End (Indicator/outward) - 2	TTTTTTTTTTTAACCAACGCTATTACGCCAGCTGGCTTTTT
Center Barrel - Left End (Indicator/outward) - 3	CATTAAAGGTGAATTATCACCGTCACCGACTTGAGCTCGGT GCGTAAGTTGGTCGC
Center Barrel - Left End (Indicator/outward) - 4	TTTTTAATTCGCGTCTCTTTATTTCAATTTTT

Center Barrel - Left End (Indicator/outward) - 5	TTTTGAAAGGGGGATGTGCTGCAATACGTAATGCCACTACGAA
Center Barrel - Left End (Indicator/outward) - 6	TTTTAATCGGTTGTACGGAGAAGCGGCCTTCTTAAATCAGCTCATTTTT
Center Barrel - Left End (Indicator/outward) - 7	TTTTTAGCATGTCAATCAGATGCCGGTTACCTGCATTTTT
Center Barrel - Left End (Indicator/outward) - 8	GGAACAACATTATTACAGGTAGAAAGATACGGGTAAAAGGCGATGGC
Center Barrel - Left End (Indicator/outward) - 9	TTTTTCGCAAGGATAAAAATGAGTAATCGTAAAACCTTTTT
Center Barrel - Left End (Indicator/outward) - 10	ACGGAGTCTGGACTTTTGCGCAAAAACATCAACATTAAATGTGAGCGTTTT
Center Barrel - Left End (Indicator/outward) - 11	TTTTTGCCAGCGGTGCAAATATATTTTTTTTT
Center Barrel - Left End (Indicator/outward) - 12	TTTTTTCACCATCAATACCTTTTTAGAACCTCATATTTTT
Center Barrel - Left End (Indicator/outward) - 13	TTTTTTCTTACCAGTAACTTTTTCCGGTGCCGCGCGCCTGTGCACTCTGTGG
Center Barrel - Left End (Indicator/outward) - 14	GAGTCTGTCCATCACGCAAATTAACCGTGTGCTCACTCCCTGCATACGG
Center Barrel - Left End (Indicator/outward) - 15	GAAAGGCCGGAGACAGTCAAATTTTT
Center Barrel - Left End (Indicator/outward) - 16	TTTTTTATTTTAAATGCAATGCCTGCGTTATACAAATTTTT
Center Barrel - Left End (Indicator/outward) - 17	TATCATATGAGTAATGGTCATTGTGATATTCAAGCCTCAGAGCATAAAGCTATTTTT
Center Barrel - Left End (Indicator/outward) - 18	TTTTTAGTTAATTTTCATCTTCTGGACTTGCGGGAGGTTTTGAG
Right Barrel - End Strand - 1	TTTTTGCTTTTGATGATAGTCAGTGCCTTGAGTAACATTTTT
Right Barrel - End Strand - 2	TTTTTGTGCCCCGATTACAGGAGGTTTTTTTT
Right Barrel - End Strand - 3	TTTTTAAGGCTCCAACCTTACCCTGATTTTT
Right Barrel - End Strand - 4	TTTTTTCATATTCCTGATCACCGTACAACAGTTAATGCCCCTTA
Right Barrel - End Strand - 5	TTTTTAGTACCGCCAGCATCACCTTGTTTT
Right Barrel - End Strand - 6	TTTTTCTATTATAGTTCAAGAAAACATTTTT
Right Barrel - End Strand - 7	TTTTTATTAATAACCGAATCTAAACCCTCA
Right Barrel - End Strand - 8	TTTTTCTGAACCTCAAATATCAAACCC
Right Barrel - End Strand - 9	TTTTTAAATTAATTACATTTAACCTAAAACATCGCCTTTTT
Right Barrel - Center Strand - 1	ACGGGCAGGAGTGTACTGGTATAATAATTATCGGTTT
Right Barrel - Center Strand - 2	GGAGTGAATAAGTTCTGCCTATTTTACCGGATGGCAATGACCATTCATC
Right Barrel - Center Strand - 3	CAACGAGCCGCCACCCTCAGGAACCGCTTCT

Right Barrel - Center Strand - 4	AACAATGAAAGTTTAAAGCCTGGATTATCAAATGCACTTCA AATA
Right Barrel - Center Strand - 5	CGTTAGTAAAGAAGGATGCCTTGAGAACCTACGGAATCGA AAGCGAACCGACCGTCCG
Right Barrel - Center Strand - 6	ACCGGAACCAGAGCCACCACCGAACCGCAATCCTCAATTA AGAGGGCG
Right Barrel - Center Strand - 7	AAACGACAATGACAACAACAATACTGCCATATCAAACGT
Right Barrel - Center Strand - 8	TCATGCCGCCACGACGATTGTAGAGACA
Right Barrel - Center Strand - 9	CCTCAAGATGAATTTAGCCACCACCCTCAGAAATC
Right Barrel - Center Strand - 10	TGAATTCGGAACAGTATAGCCCGGAATCCTCAGAAGAAAC CAACCAGCAGAAAAGAATTG
Right Barrel - Center Strand - 11	ATCAGCTAACGAGAATTCATCAAGGAACAAACCGCCACCCT GAGAGC
Right Barrel - Center Strand - 12	TAAACAGCTTGAATCCCCCTACTTCTGTTTTAAACAGGGAT AGACAACCTCAACA
Right Barrel - Center Strand - 13	CGCCCGCAGGTCACAGAACCAGTCGTCTTTCCAGA
Right Barrel - Center Strand - 14	GATAAGTGCCGTTCAATTTGTTGAGTCAG
Right Barrel - Center Strand - 15	ATTCCACGATTAGCGGGCCCATGTATGAATATACAGTAACC GAGCTTCTCATAAATATTC
Right Barrel - Center Strand - 16	TGTTAGAATGGAAGGTGAATCTCCCTCACTAAAGGAATTGC GAAGAATAGAATCTC
Right Barrel - Center Strand - 17	ATTGATACCGATAACAAATAACCCTCAGTCTGTATGGGATT TTGCTA
Right Barrel - Center Strand - 18	GAACCGCCACAGGTGTATTATCAGATTTCCAGTATTTAATT GTTTTTCAC
Right Barrel - Center Strand - 19	CAGACCGTAACAATTTAGAAGTATTAGCTTT
Right Barrel - Center Strand - 20	AAAAAGATTAACCTGAGCAAGATAAACTTTAATGTGGTCAG TTGGCAAA
Right Barrel - Center Strand - 21	AAAGTTTAAACAGTTCAGAATGCTTTCGAAGCGCAGAGGA ACAAAGTTTCAGC
Right Barrel - Center Strand - 22	TCGCGAATCGCGCTATTAAGGCACAGAATTGAGGAAGG TTA
Right Barrel - Center Strand - 23	TAATTGTTATTAATAAATGAGCAGTACCAGCTGAGACT
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Right Barrel - Center Strand - 25	CACGCTCAGAGCCACCACCCCGAGAGGGTGAT
Right Barrel - Center Strand - 26	CCGCGAAAGGACAATATTTTTGAATGGCAGTACATATTATT CA
Right Barrel - Center Strand - 27	ATTCGCAAGCCAATAGGAAGTTTTGCTAAGGGTTATATTC ACAAGTTGCCATC
Right Barrel - Center Strand - 28	TATTAGAGGCGAAAATCAATATATGTGAGTGAATAGAATA CGTTCCTTTGCAACA

Right Barrel - Center Strand - 29	TTTCAATTAGAGGAAGCATTTTGCTATAATCCTTGATATACT ATTATTCTGAAACACTTT
Right Barrel - Center Strand - 30	TCAAAAATGAAAAACGAACCCCAAGGAAGCGGATAAAT CAAA
Right Barrel - Center Strand - 31	TCAACAGTTCTGCAACAGAGGCGGTAACATTATCCCG
Right Barrel - Center Strand - 32	TCTAAAATATACTTTACACCGAACAGTACCTTTTTTGCTTTTC TGTAATCGTCGC
Right Barrel - Center Strand - 33	AGGAGACCTGAAAGCGTAAACCTTGCTGAATACCAAGTTA CAATTT
Right Barrel - Center Strand - 34	AATTACCTTTTTAATGGAAACTATTAGTACAGAGGTGTGC
Right Barrel - Hinge End - 1	TTTTTGATCTAAAGTTTTCCACCAGAGCCGCCCATTTTT
Right Barrel - Hinge End - 2	GGTCATAGCCCCCTTATTAGCGTTTGCCATCTTT
Right Barrel - Hinge End - 3	GCCCTCATAGTTAGCGTAACTTTTT
Right Barrel - Hinge End - 4	TTTTTGCATTGACAGGAAACAGAAATATTTTT
Right Barrel - Hinge End - 5	TTTTTAACTACAACGCCGCACGTAAGGTTGAGACGCATAA CCGATATATTCGG
Right Barrel - Hinge End - 6	ATAGTAAAATGTTTAGACTGGATAGCGTCCCAT
Right Barrel - Hinge End - 7	TAGATTTTCTCCAACAGGTCAGGATTAGA
Right Barrel - Hinge End - 8	TTTTTAAGAAATTGCGCCAGTAATAAATTTTT
Right Barrel - Hinge End - 9	TTTTTCAATAGATAATACCACACGA
Right Barrel - Hinge End - 10	CTGAACATCGGGACCCTTCTGCACTAACAATAATAGATTA GAGCCGTTTTTT
Right Barrel - Hinge End - 11	TTACATTGGCAGATTCACCAGTTAACGGATGAAGCAAACAG GTTTAAATTATTTGTAGC
Right Barrel - Hinge End - 12	TTTTTAGGGACATTCTGGCCAACAATTTCCCTTAGAATCCT TGA
Right Barrel - Hinge End - 13	TATTAATTAGAGATAGAAGAAACAAATTTGAGGCTGAGTTT CGTCACCAGTACTTTTT
Left Barrel - End Strand - 1	TTTTTCCGGCGAACGTGGCCACAAGAATTGAGTTAAGTTTT T
Left Barrel - End Strand - 2	TTTTTCCAATAATAAGAGCTAAAGAACGTGGAGATAACCG AGAAAGGAA
Left Barrel - End Strand - 3	TTTTTGTGCTTTGAGCCCTGACGAGTTTTT
Left Barrel - End Strand - 4	TTTTTCAGGCGCATAGGCTATAAGAAACAATGAAATATTTTT T
Left Barrel - End Strand - 5	TTTTTGCAATAGCTAGGCCAACGCGCTTTTT
Left Barrel - End Strand - 6	TTTTTAAACACCAGACCTGATAAATTTTTTT
Left Barrel - End Strand - 7	TTTTTTTTGAAAGAGGACAATGAATCTCTTA
Left Barrel - End Strand - 8	TTTTTGGGAGAGGCGGTTTGCCTATTGGGCGCT
Left Barrel - End Strand - 9	TTTTTGTGTCGAAATCCGCGACCCGAACTGACCAACTTTTT
Left Barrel - Hinge End - 1	TTTTTATAACATAAAAAACAGGGAAGCGCATTATG
Left Barrel - Hinge End - 2	GTCTTTTGCACGAACGGTACGCCAGAATCCTGAGAAGTGT
Left Barrel - Hinge End - 3	TTAAATCAAGATTAGTTGCTATTTCCAGAGCCTAATTTTT

Left Barrel - Hinge End - 4	AAAATAAATAATCCTCACACGTTTTCGCTCATTATACCAGT CAGGACGTTGGGAAG
Left Barrel - Hinge End - 5	TTTTTTTTGCCAGTTACAAGCAGCCT
Left Barrel - Hinge End - 6	TTTTTTTTGATGGTGGTTACAGAGAGATTTTT
Left Barrel - Hinge End - 7	CTGCGGCCAGAAATGCGGCGGGCGTTGAGGATCCCCTTTTT
Left Barrel - Hinge End - 8	TTTTTGGGTACCGAGCTCTACGCAGGCGAAAATCCTGTTTT T
Left Barrel - Hinge End - 9	TTTTTACGCTGGTTTGCCCAACAAAAGAACCCCTGAGAAA GGTGGCA
Left Barrel - Hinge End - 10	TATGTCAAAGAACAAGGGGCGACATTCAACCGATTGAG GG
Left Barrel - Hinge End - 11	CACCAACCTAAAACGAAAGAGGTAGCAAACGTAGATTTTT
Left Barrel - Hinge End - 12	TTTTTAAATACATACATAGAGTTGCAGCAAGCGTCCTTTTT GGGAAGCGCTTAGCTTTCCTCGTTAGAAAACAAAGCAGAG TAATATTCCACAAAGT
Left Barrel - Center Strand - 1	AGCGGGTAATTGAGCGCTAATATCAGAGACTCCAACCCCC GACTTCATCATGCTCATGCT
Left Barrel - Center Strand - 2	AGGGCGCTGGCAAGGAACCAATCAAATAAGCTATGCGT G
Left Barrel - Center Strand - 3	ACCAGAATTAAGTGAACACCCTGAACAATCAAGAAACGATT TTAAAGAATAGCC
Left Barrel - Center Strand - 4	CAAAGTCCAGTTTGGAACAATTTAAGAACAACATACGAGCT GATAAATTGGTCAGTGAA
Left Barrel - Center Strand - 5	AATCGGAGCTAACTGCGCGTAACCACCACACCCGCCGAAA GCGAAAAGGGAGCGT
Left Barrel - Center Strand - 6	CCGATTATTCTGCCAGCACTCATGTGAATTA
Left Barrel - Center Strand - 7	ACAGCCAGCTACAATTTTATCCTTGAGCGGTCACGACAGG AGG
Left Barrel - Center Strand - 8	CGAGATTACCAGGTGTGAAAGTGAAGTCCCCAGCAGAAA ATTCATATGGTT
Left Barrel - Center Strand - 9	TTCCGAAATCGGCAATAACGGAAGAATTTCGCAG
Left Barrel - Center Strand - 10	CCTGTTCTGTTTCTAAGGAAACGCGTTGCGCTCA
Left Barrel - Center Strand - 11	GTCATACCGGGGAAGGGATTTTATTATTCTT
Left Barrel - Center Strand - 12	CCGAAGCCCTTGAGTCCACTGGCTGACTTTAGAGCTATAAC GTATGCGCCG
Left Barrel - Center Strand - 13	AAGCAAACCTGTCGTGCCAGCCAGGGTCAATCATAAGGGA ACTGCTCCATGAGATTTG
Left Barrel - Center Strand - 14	TAGTTTCGCGTCATAAATCATTGTTAACGTCAAAAAGACG GGAACGCTAACGAGC
Left Barrel - Center Strand - 15	TGAGATGGTTTAAAAACAAAGTGAAAGCCAGACGGTGGT TTT
Left Barrel - Center Strand - 16	CAACTCGCTCACACTTGACAAAGTGTGTGGCGAAAAACCG TCTAAGTCAGAGGGCGCT
Left Barrel - Center Strand - 17	



Left Barrel - Center Strand - 18	TCATTTACCCAAATCAACGTTTCAGAGCGGGAAACCCTAAGG CCTTATATCTTTGAAACTCACACGCAAAGAAGCTGATTGCC CTTCACCGCCTGGTGG
Left Barrel - Center Strand - 19	GCATTAGACGGAAGCATAAAGTACAACGTTACTT
Left Barrel - Center Strand - 20	CTGCGGGCAACCACCACGGAATAAGTTTATTTGCGCTGG
Left Barrel - Center Strand - 21	CATGATTAAGATTGAGGAAACGCAATAAAATCCCTTCGTG AGCCAGCCATATTAG
Left Barrel - Center Strand - 22	GGTGCAGTCGGGAGATAGCCGAACAAAGTAGGGTTGGAA CCGGAACTA
Left Barrel - Center Strand - 23	TCTTTTCACCAGTGAGACCCGCTTCCCTAATGATTGTTATC TAA
Left Barrel - Center Strand - 24	ACATATCGCCAAAGATACACTAAAACACTCGCGATTTTGTC A
Left Barrel - Center Strand - 25	AGCCGGAACGAGTGTCACAATCAATGATTATACCAAGCGC GTTT
Left Barrel - Center Strand - 26	TACCAGAAAAGAAATTAACCTTATTACGTAATCATGAAG AACTGACG
Left Barrel - Center Strand - 27	

**Table S4** Strut Staples, PolyT Staples, and Pinch Staples

<b>Staple Names</b>	<b>Sequence</b>
Length 12 - Overhang Base-B-1	GGGTCCCTACTAGCGCGCCCAATAGCAAGGTAGAAACCTTAGGTTAA TTTAGGCTGTTTAGCTATATTTGGT
Length 12 - Overhang Base-B-2	GGGTCCCTACTAGTAATGCTGGGCCTTGACCTCCGGCAATCAATACA AGAAAAATAATATCC
Length 12 - Overhang Base-B-3	GGGTCCCTACTAGCGGAACGAGGGTAGCATGCCAAGCAAACCCAGGC AAAGCGCCATTCGCCTAGCACCAGAG
Length 12 - Overhang Base-A-1	TGACTCGCTTCGAATAACATTACGGTGTCCAATTCCCCTTACACAA AAACAAAACGTTAATAT
Length 12 - Overhang Base-A-2	TGACTCGCTTCGCACATTCAAAAGACTTCCCAGTCATGCGCAACCAG CCAGCTTTCC
Length 12 - Overhang Base-A-3	TGACTCGCTTCGCCAGCAAATCACCAGATTCAGGCCGACGTTGTAA ATTGTGGAAGATTGTATAAGTCAT
Length 12 - Overhang Side Left-1	CTAGTAGGACCCCTACAGGGCGCGTACTATGTTTTT
Length 12 - Overhang Side Left-2	CTAGTAGGACCCTAAGGCTTCGAGCACGTTGACGGGGAAAGTTTTT
Length 12 - Overhang Side Left-3	CTAGTAGGACCCTATCATCGACGAGTAGACGGTGTACAGACTTTTT
Length 12 - Overhang Side Right-1	CGAAGCGAGTCAAACAAACACAGAAGCAAGCGGAATTATCATTTTT
Length 12 - Overhang Side Right-2	CGAAGCGAGTCAAATCAGGTAAGGAGCCAGCGTCATACATGTTTTT
Length 12 - Overhang Side Right-3	CGAAGCGAGTCAGTTGAAAATCTCCAAAAATTTTT
Length 8 - Overhang Base-B-1	CCTACTAGCGCGCCCAATAGCAAGGTAGAAACCTTAGGTTAATTTA GGCTGTTTAGCTATATTTGGT
Length 8 - Overhang Base-B-2	CCTACTAGTAATGCTGGGCCTTGACCTCCGGCAATCAATACAAGAA AAATAATATCC
Length 8 - Overhang Base-B-3	CCTACTAGCGGAACGAGGGTAGCATGCCAAGCAAACCCAGGCAAAG CGCCATTCGCCTAGCACCAGAG
Length 8 - Overhang Base-A-1	TCGCTTCGAATAACATTACGGTGTCCAATTCCCCTTACACAAAAAC AAAACGTTAATAT
Length 8 - Overhang Base-A-2	TCGCTTCGCACATTCAAAAGACTTCCCAGTCATGCGCAACCAGCCAG CTTTCC
Length 8 - Overhang Base-A-3	TCGCTTCGCCAGCAAATCACCAGATTCAGGCCGACGTTGTAATTG TGAAGATTGTATAAGTCAT
Length 8 - Overhang Side Left-1	CTAGTAGGCTACAGGGCGCGTACTATGTTTTT
Length 8 - Overhang Side Left-2	CTAGTAGGTAAGGCTTCGAGCACGTTGACGGGGAAAGTTTTT

Length 8 - Overhang Side Left-3	CTAGTAGGTATCATCGACGAGTAGACGGTGTACAGACTTTTT
Length 8 - Overhang Side Right-1	CGAAGCGAAACAAACACAGAAGCAAGCGGAATTATCATTTTT
Length 8 - Overhang Side Right-2	CGAAGCGAAATCAGGTAAGGAGCCAGCGTCATACATGTTTT
Length 8 - Overhang Side Right-3	CGAAGCGAGTTGAAAATCTCCAAAAATTTTT
Replacement - Overhang Base-B-1	CGCGCCCAATAGCAAGGTAGAAACCTTAGGTTAATTTAGGCTGTTA GCTATATTTGGT
Replacement - Overhang Base-B-2	TAATGCTGGGCCTTGACCTCCGGCAATCAATACAAGAAAAATAAT ATCC
Replacement - Overhang Base-B-3	CGGAACGAGGGTAGCATGCCAAGCAAACCAGGCAAAGCGCCATTC GCCTAGCACCCAGAG
Replacement - Overhang Base-A-1	AATAACATTACGGTGTCCAATTCCTTACACAAAAACAAAACGTT AATAT
Replacement - Overhang Base-A-2	CACATTCAAAAGACTTCCGAGTCATGCGCAACCAGCCAGCTTTCC
Replacement - Overhang Base-A-3	CCAGCAAATCACCAGATTCAGGCCGACGTTGTAATTTGTGGAAGA TTGTATAAGTCAT
Replacement - Overhang Side Left-1	CTACAGGGCGCGTACTATGTTTT
Replacement - Overhang Side Left-2	TAAGGCTTCGAGCACGTTGACGGGGAAAGTTTT
Replacement - Overhang Side Left-3	TATCATCGACGAGTAGACGGTGTACAGACTTTTT
Replacement - Overhang Side Right-1	AACAAACACAGAAGCAAGCGGAATTATCATTTTT
Replacement - Overhang Side Right-2	AATCAGGTAAGGAGCCAGCGTCATACATGTTTT
Replacement - Overhang Side Right-3	GTTGAAAATCTCCAAAAATTTTT
Poly-T - Length 10 - CR - 1	TTTTTTTTTATGTTTACCAGTCGCGGTTGTGTACATCGACATTTTTT TTT
Poly-T - Length 10 - CR - 2	TTTTTTTTTTAAAAAATCGTCAGCGTGGTTTTTTTTTT
Poly-T - Length 10 - CR - 3	GCTGAGGCTTGACGGGAGTTAAACGTACAGCGCCTTTTTTTTT
Poly-T - Length 10 - CR - 4	TTTTTTTTTCTTTCGCACTCAATGTAGAAC
Poly-T - Length 10 - CR - 5	TTTTTTTTTGTGCTGCTGGGTCCAGACGACTTTTTTTTT
Poly-T - Length 10 - CR - 6	GTACCTTTAATTGCTCCTTTGTGCTTGCAGGCGTTTTTTTT
Poly-T - Length 10 - CR - 7	TTTTTTTTTTCGCTGAGAAGAGTGTAATTCTTCAGCAGCAACCGCAA GCCGGACTTCC
Poly-T - Length 10 - CR - 8	TTTTTTTTTTGACAATAAACAAACATGTTTCAGCTAATAAGGTAACAA
Poly-T - Length 10 - CR - 9	AAACCAAGTACCGGATTAAGATTTTTTTTT

Poly-T - Length 10 - CL - 1	TTTTTTTTTAGTAAACAACCCGTAGGAACGCCATCAAAAATTTTTTTT TTT
Poly-T - Length 10 - CL - 2	TTTTTTTTTTTTTTTTAACCAACGCTATTACGCCAGCTGGCTTTTTTTTT T
Poly-T - Length 10 - CL - 3	TTTTTTTTTAAATTCGCGTCTCTTTATTTCAATTTTTTTTTT
Poly-T - Length 10 - CL - 4	TTTTTTTTTCAAAGGGGGATGTGCTGCAATACGTAATGCCACTACG AA
Poly-T - Length 10 - CL - 5	TTTTTTTTTAAATCGGTTGTACGGAGAAGCGGCCTCTTAAATCAGCT CATTTTTTTTTT
Poly-T - Length 10 - CL - 6	TTTTTTTTTAGCATGTCAATCAGATGCCGGTTACCTGCATTTTTTTTT TT
Poly-T - Length 10 - CL - 7	TTTTTTTTTCGCAAGGATAAAAATGAGTAATCGTAAACTTTTTTTTT TTT
Poly-T - Length 10 - CL - 8	ACGGAGTCTGGACTTTTGCACAAAACACATCAACATTAATGTGA GCGTTTTTTTTT
Poly-T - Length 10 - CL - 9	TTTTTTTTTGCCAGCGGTGCAAATATTTTTTTTTTTTTT
Poly-T - Length 10 - CL - 10	TTTTTTTTTCCACATCAATACCTTTTTAGAACCTCATTTTTTTTTT T
Poly-T - Length 10 - CL - 11	TTTTTTTTTCTTACCAGTAACTTTTTCCGGTGCCGCGCCTGTGC ACTCTGTGG
Poly-T - Length 10 - CL - 12	GAAAGGCCGGAGACAGTCAAATTTTTTTTTT
Poly-T - Length 10 - CL - 13	TTTTTTTTTATTTTAAATGCAATGCCTGCGTTATACAAATTTTTTTTT T
Poly-T - Length 10 - CL - 14	TATCATATGAGTAATGGTCATTGTGATATTCAAGCCTCAGAGCATAA AGCTATTTTTTTTT
Poly-T - Length 10 - CL - 15	TTTTTTTTTAGTTAATTTTATCTTCTGGACTGCGGGAGGTTTTGAA G
Poly-T - Length 10 - Right 1	TTTTTTTTTGATCTAAAGTTTTCCACCAGAGCCGCCCATTTTTTTTT TT
Poly-T - Length 10 - Right 2	GCCCTCATAGTTAGCGTAACTTTTTTTTTT
Poly-T - Length 10 - Right 3	TTTTTTTTTGCAATGACAGGAAACAGAAATTTTTTTTTT
Poly-T - Length 10 - Right 4	TTTTTTTTTAAACTACAACGCCGCACGTAAGGTTGAGACGCATAAC CGATATATTCGG
Poly-T - Length 10 - Right 5	TAGATTTTCTCCAACAGGTCAGGATTAGA
Poly-T - Length 10 - Right 6	TTTTTTTTTAAGAAATTGCGCCAGTAATAAATTTTTTTTTT
Poly-T - Length 10 - Right 7	TTTTTTTTTCAATAGATAATACCACACGA
Poly-T - Length 10 - Right 8	CTGAACATCGGGACCCTTCTGCACTAACAATAATAGATTAGAGCCG TTTTTTTTTT

Poly-T - Length 10 - Right 9	TTTTTTTTTAGGGACATTCTGGCCAACAATTTCCCTTAGAATCCTTGA
Poly-T - Length 10 - Right 10	TATTAATTAGAGATAGAAGAAACAAATTTGAGGCTGAGTTTCGTCA CCAGTACTTTTTTTTTT
Poly-T - Length 10 - Left 1	TTTTTTTTTATAACATAAAAAACAGGGAAGCGCATTATG
Poly-T - Length 10 - Left 2	TTAAATCAAGATTAGTTGCTATTTCCAGAGCCTAATTTTTTTTTT
Poly-T - Length 10 - Left 3	TTTTTTTTTTTTGCCAGTTACAAGCAGCCT
Poly-T - Length 10 - Left 4	TTTTTTTTTTTTGATGGTGGTTACAGAGAGATTTTTTTTTT
Poly-T - Length 10 - Left 5	CTGCGGCCAGAATGCGGCGGGCGTTGAGGATCCCCTTTTTTTTTT
Poly-T - Length 10 - Left 6	TTTTTTTTTTGGGTACCGAGCTCTACGCAGGCGAAAATCCTGTTTTT TTTT
Poly-T - Length 10 - Left 7	TTTTTTTTTACGCTGGTTTGCCCAACAAAAGAACCCTGAGAAAG GTGGCA
Poly-T - Length 10 - Left 8	CACCAACCTAAAACGAAAGAGGTAGCAAACGTAGATTTTTTTTTT
Poly-T - Length 10 - Left 9	TTTTTTTTTTAAATACATACATAGAGTTGCAGCAAGCGGTCTTTTTT TTTT
Pinch Staple - Length 15 - Left - 2 (inner)	AAAATAAATAAATCCTCACAGTTTTTCGCTCATTA
Pinch Staple - Length 15 - CL - 3 (inner)	CGTCACCGACTTGAGCTCGGTGCGTAAGTTGGTCGC
Pinch Staple - Length 15 - CR - 3 (inner)	GCCGGATCGGCGAAAGGCCGACGACAG
Pinch Staple - Length 15 - CL - 2 (inner)	AGAAAGATACGGGTAAAAGGCGATGGC
Pinch Staple - Length 15 - CR - 2 (inner)	TAGTGTCAGCGGGGATAAGAGCGACGATA
Pinch Staple - Length 15 - CL - 1 (inner)	TTAACCGTGTGCTACTCCCTGCATACGG
Pinch Staple - Length 15 - CR - 1 (inner)	ACATAGCGATAGCTTACACTCATCGAGAACAGGAAAA
Pinch Staple - Length 15 - Right - 1 (inner)	TAACGGATGAAGCAAACAGGTTTAAATTATTTGTAGC
Pinch Staple - Length 15 - left - 1	GTCTTTTGACGAACGGTACGCCAGAATCCTGAGAAGTGTTTTTATA ATCAGTGA
Pinch Staple - Length 15 - Left - 2	TACCAGTCAGGACGTTGGGAAGAAAAATCTACGTTA
Pinch Staple - Length 15 - Left - 3	TATGTCAAAGAACAAGGGCGACATTCAACCGATTGAGGGAGG GAAGGTAAATA
Pinch Staple - Length 15 - CR - 3	AATCAAGTTTGCCTTAGCGTCAGACTGTAGCGCGTT
Pinch Staple - Length 15 - CL - 3	TTGACGGAAATTATTCATTAAGGTGAATTATCAC

Pinch Staple - Length 15 - CR - 2	AAAACAAAATAGCGAGAGGCTTTTGCAAAGAAGTT
Pinch Staple - Length 15 - CL - 2	ATAAACGAACTAACGGAACAACATTATTACAGGT
Pinch Staple - Length 12 - CR - 1	ACGCTCATGGAAATACCTACATTTTGACGCTCAATCG
Pinch Staple - Length 15 - CL - 1	GGCCACCGAGTAAAAGAGTCTGTCCATCACGCAA
Pinch Staple - Length 15 - Right - 3	TTCATCGGCATTTTCGGTCATAGCCCCCTTATTAGCGTTTGCCATCTT T
Pinch Staple - Length 15 - Right - 2	TTGCCAGAGGGGTAATAGTAAATGTTTAGACTGGATAGCGTCCC AT
Pinch Staple - Length 15 - Right - 1	TCTGAAATGGATTATTTACATTGGCAGATTCACCAGT

