Supporting Information to

DNA origami nanopores for controlling DNA translocation

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Contents

1. SEM image of a representative bare nanocapillary

Uncoated glass nanocapillaries were imaged with a Philips XL30 FEGSEM. The acceleration voltage was 2 kV.

(a) (b)

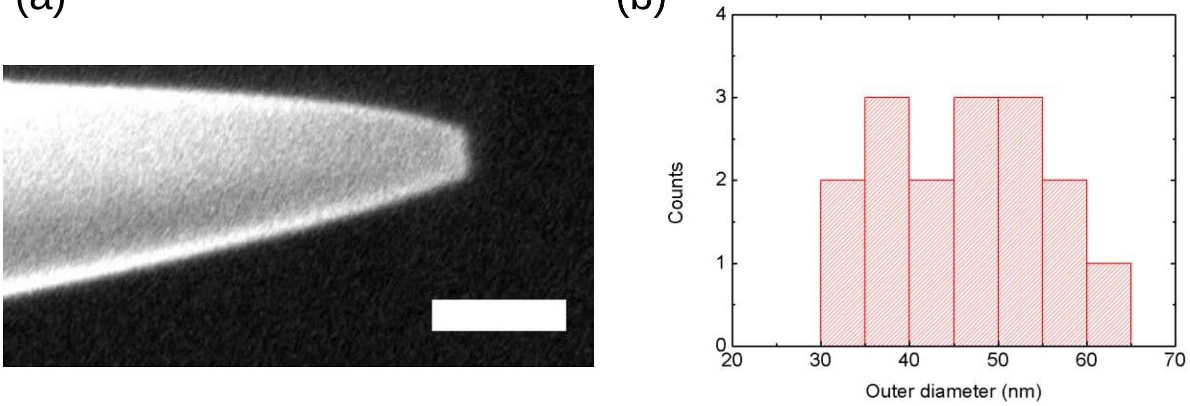

Figure S1. (a) Scanning electron microscopy image shows the conical shape of a glass nanocapillary. Scale bar = 100 nm. (b) Histogram of the outer diameter of 16 nanopores observed by SEM images. An outer diameter of mean 46 nm and standard deviation 9 nm was measured.

2. Schematic representation of the devices containing the glass nanocapillaries

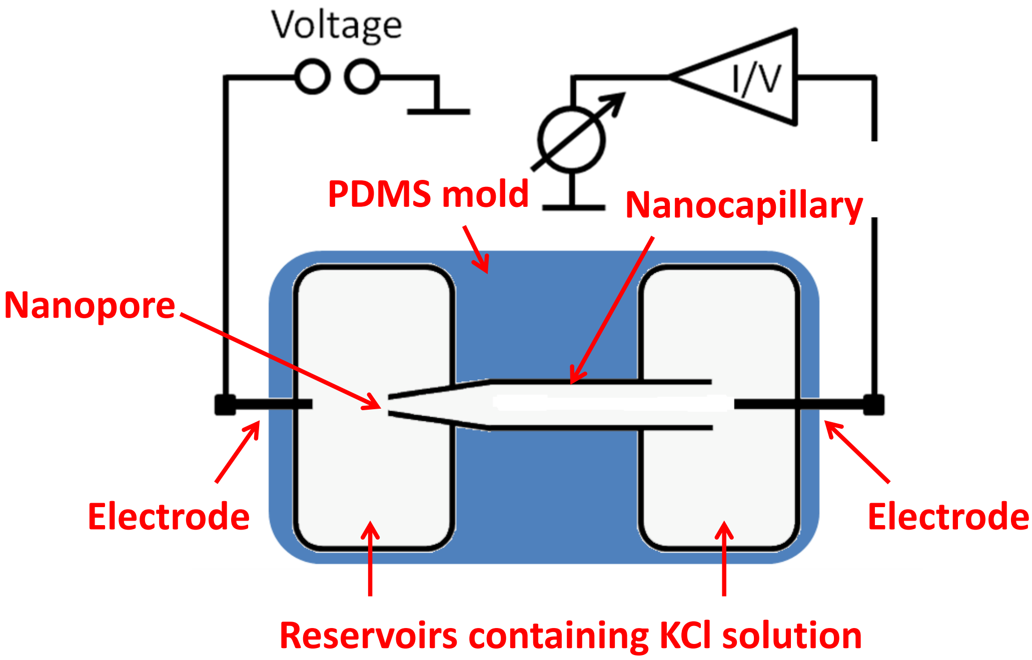

Figure S2. Device schematic

3. Agarose gel analysis of purified DNA origami structures

A bright and narrow band which moves similarly to the M13mp18 scaffold is observed for all DNA origami structures. This feature indicates well folded structures.

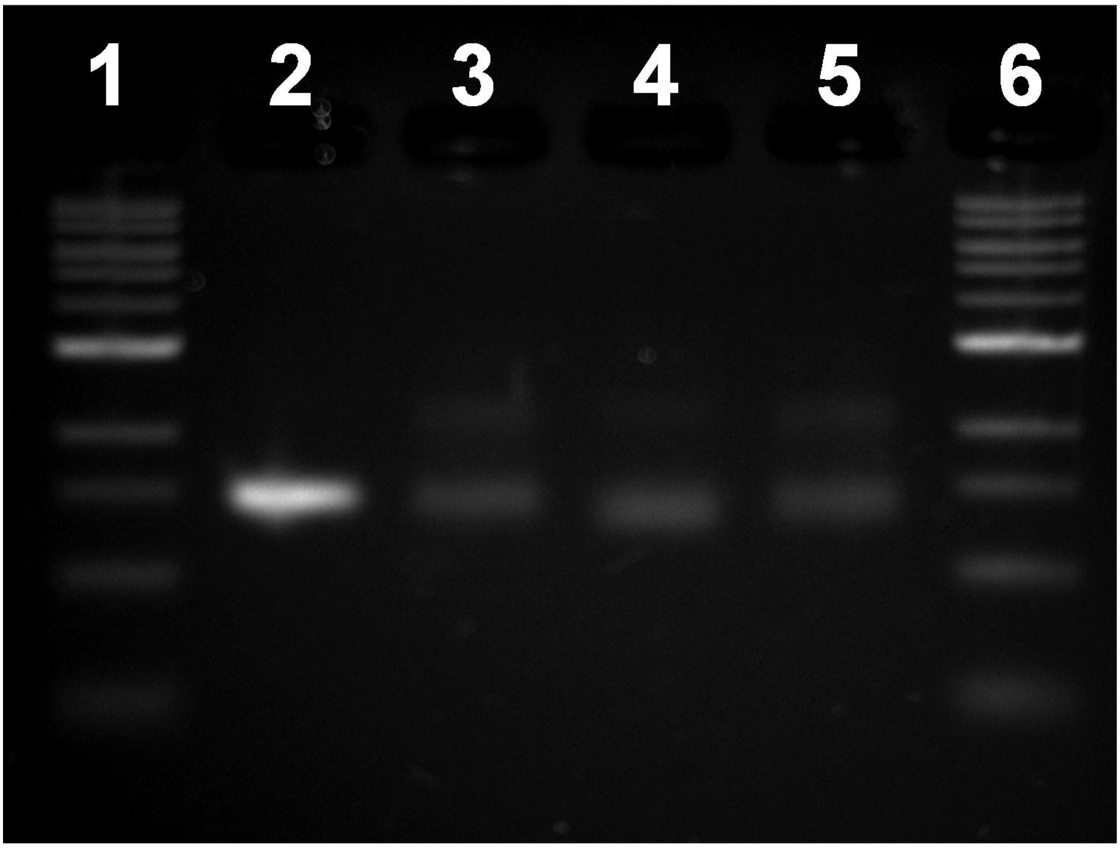

Figure S3. Agarose gel analysis of purified DNA origami structures. Structures were electrophoresed in 11 mM $MgCl_2$ solution buffered with 0.5 × TBE.

1 and 6 = 1 kb DNA Ladder.

2 = M13mp18 scaffold.

3 = 14 nm Cy3 fluorescently labelled DNA origami structure.

4 = 5 nm DNA origami structure.

5 = 14 nm DNA origami structure.

4. Ionic current noise in bare nanocapillary and hybrid nanopore

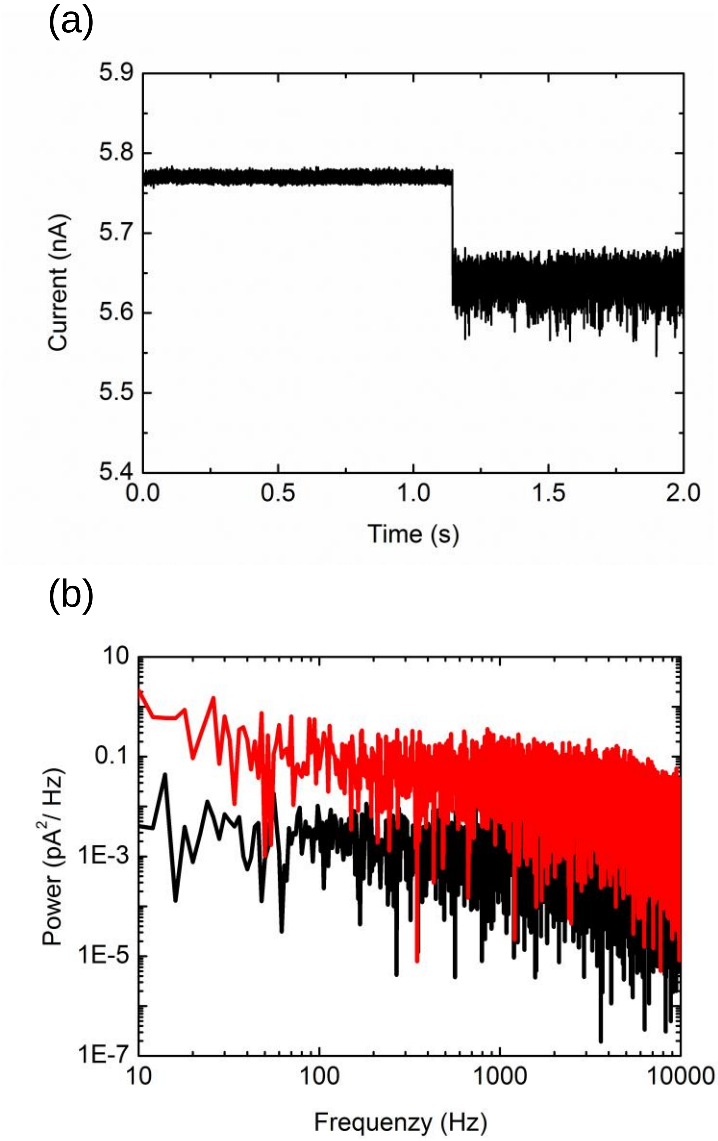

Figure S4. a) Ionic current trace recorded for one of the 14 nm pore DNA origami trappings. b) A comparison of the current power spectral density of a bare nanocapillary (black) and its corresponding hybrid one (red). Both correspond to 0.5 s of the ionic trace before (black) and after trapping (red). A significant enhancement in 1/f type low-frequency noise is observed in the hybrid nanopore, as expected due to the fluctuations produced by the DNA origami structure.

5. Schematic representation and AFM image of ‘5 nm’ DNA origami structure

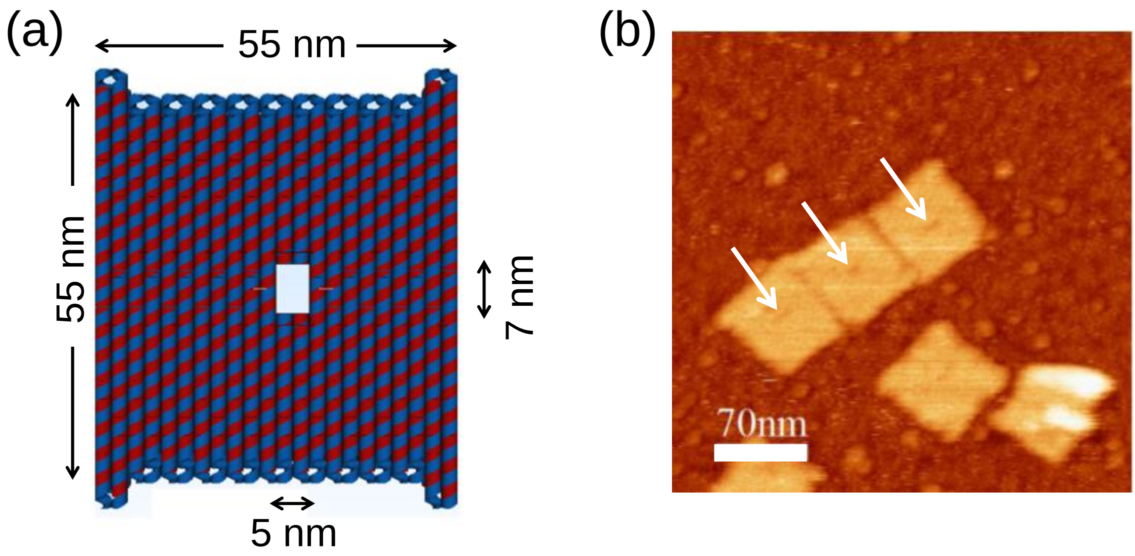

Figure S5. a) Schematic representation of the DNA origami structure with a central 5 nm x 7 nm pore. b) Topographic AFM image of assembled DNA origami structures deposited on mica and imaged in solution. The pores are indicated by white arrows.

6. Reversible and repeated trapping and ejection of DNA origami (5 nm design) on the glass nanocapillary and histogram of the percentage drop in ionic current.

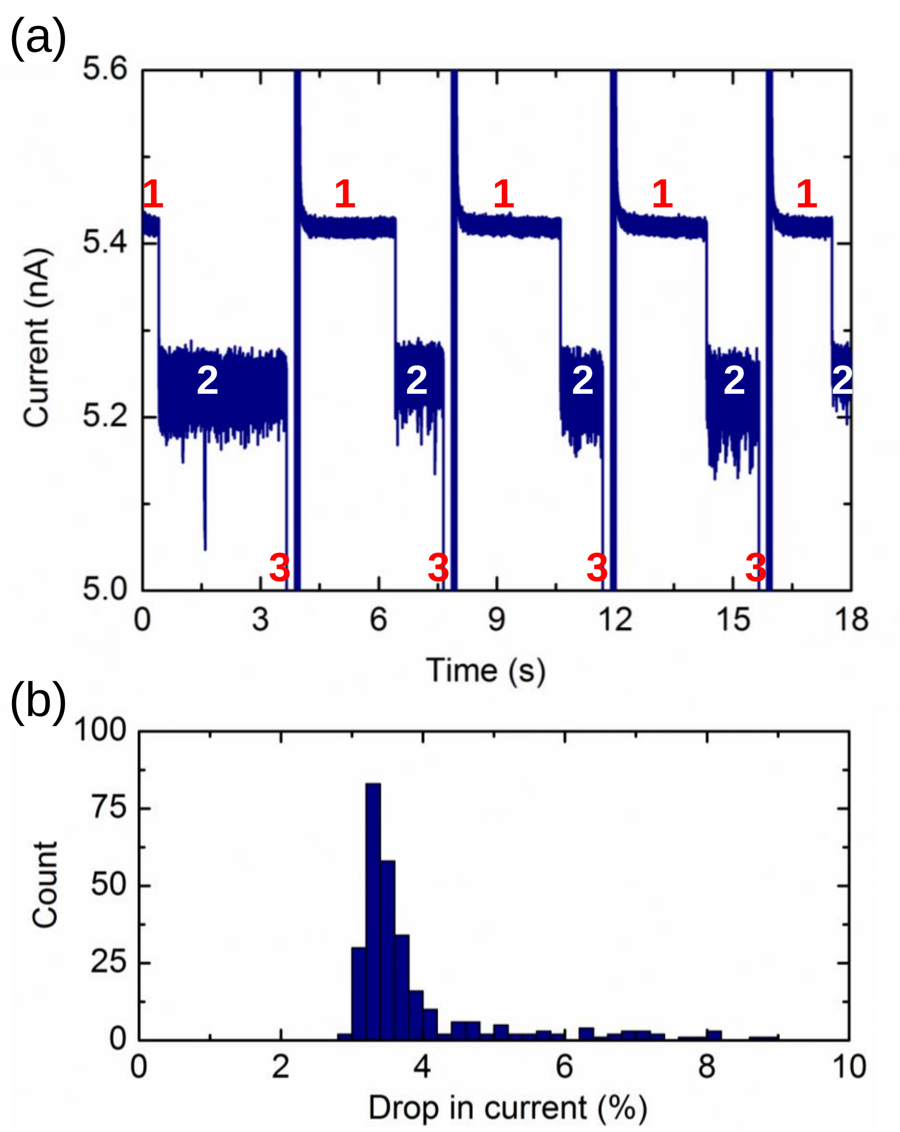

Figure S6. a) Ionic current trace showing reversible and repeated trapping and ejection of DNA origami on the glass nanocapillary ('5 nm' design). 1: Ionic current at 300 mV in the bare nanocapillary; 2: Ionic current at 300 mV once the DNA origami has been trapped; 3: Ionic current upon applying negative voltage. b) Histogram of the percentage drop in ionic current produced for 302 origami trappings on one individual nanocapillary.

7. Ionic current traces showing DNA origami trapping

a) 14 nm design

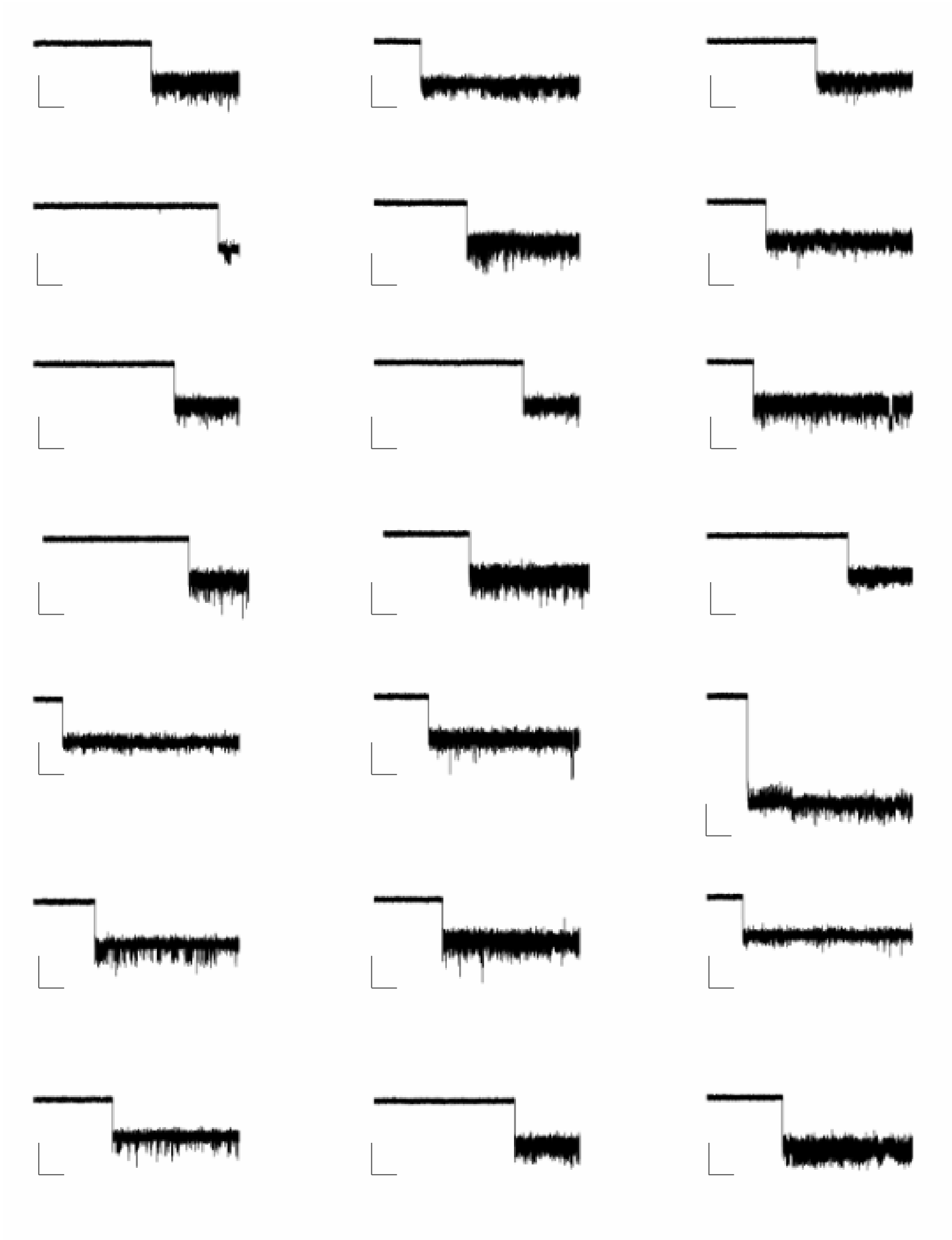

Figure S7. Ionic current traces showing 14 nm pore DNA origami trappings. These traces are some examples of the 352 trappings recorded for the experiment cited in the main text (Figure 1e). Scale bar: *Y* axis is ionic current (100 pA) and *X* axis is duration (0.25 s).

b) 5 nm design

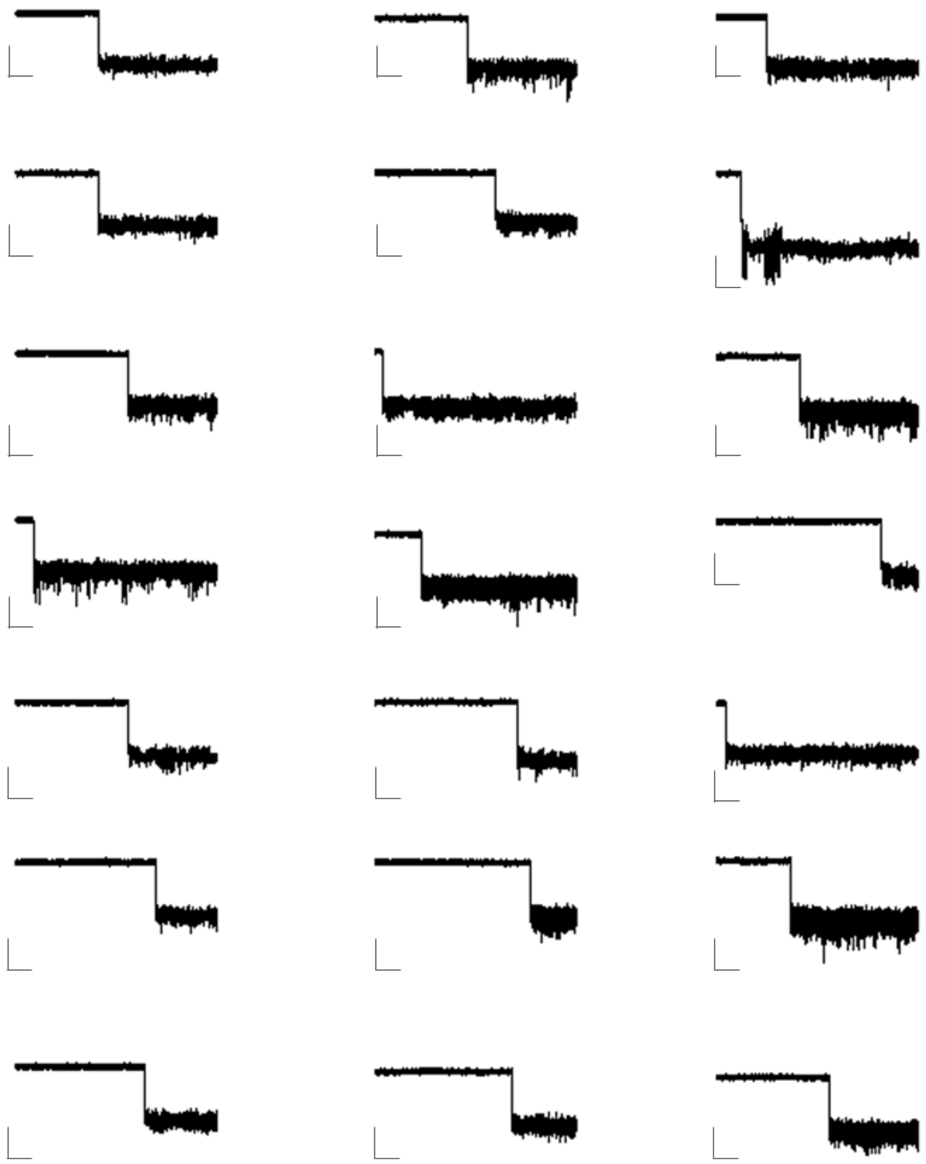

Figure S8. Ionic current traces showing '5 nm'DNA origami trappings. These traces are some examples of the 302 trappings recorded for this experiment. Scale bar: *Y* axis is ionic current (100 pA) and *X* axis is duration (0.25 s).

c) 14 nm design labelled with Cy3

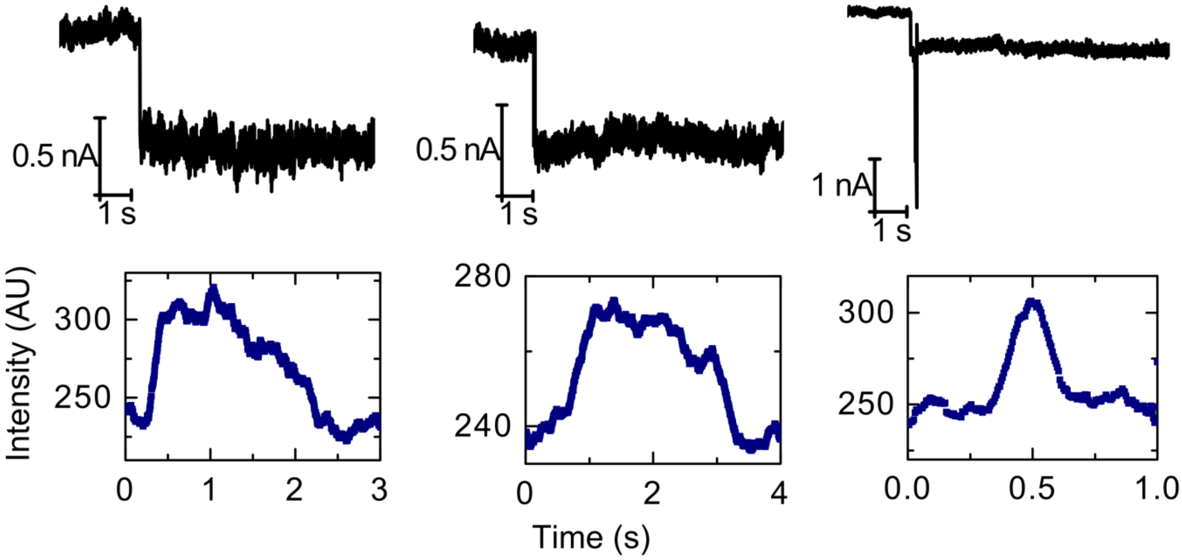

Figure S9. Ionic current traces (top) showing 14 nm labelled with Cy3 DNA origami nanopore trappings. The fluorescence intensity at the nanocapillary tip corresponding to each insertion is shown (below). Photobleaching occurs on a consistent timescale across insertions.

8. Staple strands sequences and scaffold-staple layout for each DNA origami structure

a) 14 nm design

Start	End	Sequence	Length
0[79]	45[71]	AAATCAAGTTTTTTGGGCGAGAAAGGAGTGTAATAAATCC	40
0[103]	45[103]	GCCCACTACGGGCGCTGTAAGCGTGCAGTCTC	32
0[143]	45[135]	TCCAACGTCAAAGGGCCGAAATCCGCCACCCAGAGCCA	38
0[175]	45[167]	GAACAAGAGTCCACTAGAATAGCCGGTGTATCAGCCCAAT	40
1[56]	47[71]	CGAACGTGGGTCGAGGTTAATGCCCCCTGCCT	32
1[88]	47[103]	AAAGGAGCGTGAACCTTCTGAAACATGAAA	30
1[112]	47[135]	GGCAAGATGGTGGTTCGAAAAACCACTCCTCAAGAGAAG	39
1[152]	47[167]	AATCAAAATTAAAGAAGTTTTGCTCAGTACCA	32
2[71]	43[71]	AATGCGCCCTAAACAGCACCAGAGACCACCGG	32
2[103]	43[103]	GCTGCGCGACAGGAACCCACCACCCCCTCAGA	32
2[135]	43[135]	GCAGGCGAAGAGGCGTAGTTAGCCGTTAGT	30
2[167]	43[167]	TGCAGCAAGTTTTTCTAACGCCTGTGCTAAAC	32
3[56]	46[56]	AGCGGGAGGCTACAGGACAAACAACTGGTAAT	32
3[88]	46[88]	ATTTTAGTAACCACCGGAAAGCCATACATG	30
3[112]	46[120]	AGAATAACGCGCGGGGAAATCCTGCCACCCTCTCAGAACC	40
3[152]	46[152]	CCAGGGTGGCGGTCCAGGATAGCAACCGTACT	32
4[71]	41[71]	GTCTGTCCAACTATCGGGCATTTTCCAATGAA	32
4[103]	41[103]	TTTATAATAATATTACCTTTAGCGCAGTAGCG	32
4[135]	41[135]	CTGCATTACAATTCCAATCTCCAATCGGTT	30
4[167]	41[167]	CGCTTTCCAAAGTGTAGAATTGCGTTCTTAAA	32
5[56]	44[56]	AGAACTCAATCACGCACCAGAGCCCCGCCGCC	32
5[88]	44[88]	CCAGAACCAGTGAGGGCCGCCACTCAGAGC	30
5[112]	44[120]	ATTGCTTATCCGCTCAATGAATCGTTTCCAGAGTAACGAT	40
5[152]	44[152]	GGAAGCATAGTCGGGATGGGATTTTAGCATTC	32
6[71]	39[71]	TCGTCTGAAGAACCCTTGAGCCATAAGGGCGA	32
6[103]	39[111]	CTCATGGACGTGGCACCATTAAAGAGGTAAATATTGACGG	40
6[135]	39[135]	TGTTTCCTTGGGTAATGCAGGGACAGCAGC	30
6[167]	39[167]	CCGAGCTCGTTGTAAACGCATAACAGCAACGG	32
7[56]	42[56]	ACAGAGATAATGGATTAAACGTCACGGTCATA	32
7[88]	42[88]	AAGAATAAATACCTACCGTAATTCAGACTG	30
7[112]	42[120]	TTTTTGGCGATTAAGTGTGTGAAATTAATTGTAAAAAAAG	40
7[152]	42[152]	GTCACGACGAATTCGTAGGTGAATAATAATAA	32
8[71]	37[71]	ATCGCCATGTGCCACGGACACCACTAGAAAAT	32
8[95]	40[88]	GCGCGAACGGAGGGAGTGAATTA	23
8[135]	40[120]	AAAGGGGGATGTGCTGGTCACCCTGTTAAAGG	32
8[167]	37[167]	GCGGGCCTTGCCGGAATAAACGGGAGAATACA	32
9[56]	40[56]	CTGCAACATAAAAATAAAAGACAATTGGGAAT	32
9[139]	40[152]	GCTTTCCGGCACCGCTTCTGGCTTCGCTAACGAGGGTCGATATAT	45
10[84]	35[71]	GCAAATGAAAAATCTAAAGCATTGAGGAACAATAATATAAGCAGA	45
10[167]	35[167]	TCGGCCTCGTCACGTTAAGTACAACATGTTAC	32
11[56]	38[56]	GAAAGGAATCACCTTGGCAAACGGGAATAA	30

11[139]	38[152]	GGATTGACCGTAATGGGATAGAGGAAGATAGGCAAATAAAATA	43
12[84]	33[71]	ATCTTTAGGAGCACTAACAACCTCGTATTAGCCCAATTAATTGAG	45
12[167]	33[167]	CCGTCGGAAAATAATTCCAACTTTTCATCAAG	32
13[56]	36[56]	TTCGACAATAATAGATAGAAAAGACGGAAT	30
13[139]	36[152]	AACCAATAGGAACGCCATCAATTCTCCGTCCTGCTCCGGAGAT	43
14[84]	31[71]	GAACGTTATTAATTTTAAAAGTCAGATGAAGAATAACATAAACAG	45
14[167]	31[167]	TAAATTTTAAAACAGGAAGCTGCTTTACCTTA	32
15[56]	34[56]	CCTGATTATTTGAGTACAGAGGGAATAAGA	30
15[96]	31[103]	GATTGTTTGTCAAAAAATAAGAAA	24
15[120]	31[135]	CAATCATATGTACCCTGACGAGAATGGTTT	30
15[152]	34[152]	AAGCCCCATGTTAAATCTGACCTGAAAGAG	30
16[71]	29[71]	CGTAAAACGAGAAACAAGCTACAACTAAGAAC	32
16[103]	29[103]	GTTAGAACTGAATACCTTAAATCACGACTTGC	32
16[135]	29[135]	GGTAATCGCATCAATACAACATTTAGGAAT	30
16[167]	29[167]	GAGTCTGGTAAATTAAAAAATCTAATAACGCC	32
17[56]	32[56]	TACATCGGAGAAATAAGTTACAAAATAAAAAC	32
17[88]	32[88]	ATTGCTTCTACCATAAATCCAATGAAAATA	30
17[112]	32[120]	AAATCAGTCAAATCACTAAAACTAGGCTTGAGAACACCAG	40
17[152]	32[152]	CTAGCTGAAGCAAACAATTGTGAACATTCAGT	32
18[71]	27[71]	ATGATGAAATAAATCATTATTTTCAATCAATA	32
18[103]	27[103]	TTATTCATCTTCTGTAACCGCACTCCAAGAAC	32
18[135]	27[135]	GGTGAGAAAAAAACAAGAGGCTTGTAAAAT	30
18[167]	27[167]	CCTGAGTAGGAGAAGCTTACCAGACTGCGGAA	32
19[56]	30[56]	AACAGTACACAAACATCCGGTATTTTTTATCC	32
19[88]	30[88]	AACCTTGTTCAATTAAACCTCCAGATTAGT	30
19[112]	30[120]	CTATTTCGGTTGTACCAGGCCGGATTGAGATTATTACAGG	40
19[152]	30[152]	CTTTTGCGATGTGTAGGCAGATACCGTTAATA	32
20[71]	25[71]	GATTAAGATTGGGTTAGTTTATCAAGAATATA	32
20[103]	25[103]	TTAGAATCGCAAATCCACAACATGATTCTGTC	32
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20[167]	25[167]	GCAAAGAACTGAAAAGGAAAACGAGACTTCAA	32
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21[88]	28[88]	TGCTGATCTTGAAAATATCATTCATCGAGA	30
21[112]	28[120]	GACAAGGTCAATAACCATAAAGCTGGGTAATATTGCAAAA	40
21[152]	28[152]	GGCGCGAGTTAGCAAAGTCCAATACGACGATA	32
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22[103]	23[111]	ACTTTTTCCGTTATACAAATTTTT	24
22[135]	24[128]	TTAGATACTTAATTGAATTGCTC	23
22[167]	24[160]	ATTCTGCGATGTTTTACTCCAACA	24
23[56]	26[56]	AATCATAACTAAATTTGTAATAAGACAATAGA	32
23[88]	26[88]	TCATATGAAATATATTAAAGTATTCAGCTA	30
23[112]	26[120]	GCGGATGGCTTAGAGCATTTCGCAAAGCGGATCCCTGACT	40
23[144]	26[152]	AATGCTGTAGCTCAACAACGAGTAGCCCGAAAGAATGACC	40
24[55]	21[55]	TATTTAACTCGAGCCAAATGGTTTTAACCTCC	32
24[95]	21[87]	AGCCAACGCTCAACAACAAAAGGTTTAGTTTATGTAAA	38
24[127]	22[104]	CTTTTGATAAGAGGTCCAGAAGCAAATAGAACGCGAGAAA	40

24[159]	21[151]	GGTCAGGATTAGAGAAAGAGGAAGATTTAGTCATTTGG	38
24[186]	21[191]	GAACCAGACCGTTTTAATTTAACAGTTAATTCTACTAATAGTA	43
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25[72]	23[87]	AAGTACCGGTAGGGCTAAAAGCCTGTTTAGTA	32
25[104]	24[96]	CAGACGACATTCTTACCAGTATAA	24
25[136]	23[143]	AAAAGATTGTACCTTTCTGAATAT	24
25[168]	23[191]	ATATCGCGGAAGCAAAAATATGCAACTAAAGTACGGTGTC	40
26[55]	19[55]	TAAGTCCTCGAGCATGAGAGTCAATTAATGGA	32
26[87]	19[87]	ATGCAGATCTTTCCTCATAGCGGAGTGAAT	30
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26[151]	19[151]	ATAAATCTGGATAGCATTAAGCCTGTAATA	30
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27[72]	22[72]	ATCGGCTGACGCGCCTTATAACTAAATTTCAT	32
27[104]	21[111]	GGGTATTAGACAATAAAATCGCAA	24
27[136]	22[136]	GTTTAGACAAAAATCACTATATTTTTTGACCA	32
27[168]	22[168]	TCGTCATAACAGTTCAGTGGCATCGATTCCCA	32
28[55]	17[55]	AATCATTAAGGCTTATCAAGAAAAGTACCTTT	32
28[87]	17[87]	ACAAGCATTTTAGCGCCTGAGCTTCGCCTG	30
28[119]	18[104]	GAAGTTTTTTCATCAGGACGCGCAGAGGCGAA	32
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29[72]	20[72]	GCGAGGCGAGCCGTTTATATATGTATAGCTTA	32
29[104]	19[111]	GGGAGGTTAACCAAGTAATCGTCG	24
29[136]	20[136]	ACCACATTAAATAGCGTTATGACCAATAAAGC	32
29[168]	20[168]	AAAAGGAAACCCTCGTCTTTATTTCAGGCAAG	32
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31[104]	17[111]	CGATTTTTTTGAAGCCAAGTTACA	24
31[136]	18[136]	AATTTCAACTAACGGAATGATATTTTCAAAAG	32
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32[119]	15[119]	AACGAGTATGTTTAACGGATTATACTTCTTGT	32
32[151]	14[139]	GAATAAGTAGGCTGGCAGCTCATTTTTT	28
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33[37]	16[33]	TGAACACCCTGGCATTAGAGAATTATCCGTAGATTTTCAGGT	42
33[72]	16[72]	CGCTAATATTACAGAGTGGCAATTTATTTGCA	32
33[133]	16[136]	GACCAGGCGCAGCTTGCCCCGGTTGATCGATGAAC	35
33[168]	16[168]	AGTAATCTACGTAACAAAGATTGTTTGCCTGA	32

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34[151]	12[139]	GACAGATGATCCGCGAGGGAACAAACGGC	29
34[186]	11[191]	CATAAGGGAACAACGAGGCGTGAGCGATGGGCGCATCGTAACC	43
35[37]	14[33]	CTTACCGAAGCCAATGAAATAGACTTTATTTTGCGGAACAAA	42
35[72]	13[84]	TAGCCGAATTGAGTTAAAATCCTTTGCCC	29
35[133]	34[133]	ATTGTGTCGAAAACGGTGTACA	22
35[168]	14[168]	TTAGCCGGCGAACTGACGCGTCTGATTCGCAT	32
36[55]	9[55]	ACCCAAAAGTATGTTACTGAACCTAACACCGC	32
36[90]	37[90]	GAAGGAAACCGAAAGGTGGCAA	22
36[151]	10[139]	TTGTATCAAACGAAAGCGCACTCCAGCCA	29
36[186]	9[191]	TTATACCAAGCCTCATCTTGGGGACGAAAGCGCCATTCGCCAT	43
37[37]	12[33]	CTTATTACGCAGAACTGGCTGGCAAATTCAATAGATAATACA	42
37[72]	11[84]	ACATACATAGGAAACGGGTTATCTAAAAT	29
37[133]	36[133]	CACCAACCTAATCGCCTGATAA	22
37[168]	12[168]	CTAAAACAGCGAAACAGGTGTAGAGTAACAAC	32
38[55]	7[55]	GTTTATTTCCAGCGCCCCGAACGATCTGGCCA	32
38[90]	7[87]	CATATAAAAGACGATTGAGTGATAGCGAAAGCGT	34
38[151]	7[151]	CGTAATGCGCATCGGATTACGCCTTTTCCCA	31
38[186]	7[190]	TTCATGAGGAAGCTTTGAGGGGAAGGGCAGTGCCAAGCTTGC	42
39[37]	10[33]	CATATGGTTTATGTCACAATCAGTATTCAAATATCAAACCCT	42
39[72]	9[84]	CATTCAACAACGCAAACTGAGAGCCAGCA	29
39[112]	8[96]	GCGGGATCCAAGAATGGCTATTAGTCTTTAAT	32
39[136]	38[133]	GAAAGACACACTACGAAGG	19
39[168]	10[168]	CTACAGAGGTTTCCATACCAGGCACGACAGTA	32
40[55]	5[55]	TAGAGCCAAAGGCCGGATTTACATTGAGTAGA	32
40[87]	5[87]	TCACCGTTAGCAGCACATTTTGGGTAATAT	30
40[119]	6[104]	CCGCTTTTAGGAGCCTTTGAACAGGAAAAACG	32
40[151]	5[151]	TCGGTCGTGCTTTCGAATCATGTACGAGCC	30
40[186]	5[190]	TGACAACAACCTACCGATAAGAGGATCGGTGCCTAATGAGTG	42
41[37]	8[33]	TTACCATTAGCGCAAAATCAGGGACATACCACCAGCAGAAGA	42
41[72]	8[72]	ACCATCGACACCGACTTCTGACCTCCTAAAAC	32
41[104]	7[111]	ACAGAATCAAATTATTAGACAATA	24
41[136]	8[136]	TATCAGCTCTGAGGCTCGCCAGGGAGCTGGCG	32
41[168]	8[168]	CAGCTTGAATCGCCCAACGACGGCCGATCGGT	32
42[55]	3[55]	GCCCCCTTCACCGGAAAATTAACCAGAATCAG	32
42[87]	3[87]	TAGCGCGCCCTCAGACCACCGATTAAAGGG	30
42[119]	4[104]	GCTCCAAATTGTCGTCGCCCCTGAGAAGTGTT	32
42[151]	3[151]	TTTTTTCTTTCTGTAAACCTGTATTGGGCG	30
42[186]	3[190]	TAGAAAGGAACACAGTTTCCGTTGCGCGTGAGACGGGCAACA	42
43[37]	6[33]	ATAATCAAAATATTAGCGTCACTTGCCTGGCAGATTCACCAG	42
43[72]	6[72]	AACCGCCTTTTTCATCGCCTTGCTACGCTCAA	32
43[104]	5[111]	ACCGCCACAAGTTTGCCGCCAGCC	24
43[136]	6[136]	AAATGAATACGTTGAAACACAACAGTCATAGC	32
43[168]	6[168]	AACTTTCAAACTAAAGAAGCCTGGCCCGGGTA	32
44[55]	1[55]	AGCATTGATGATATTCGCGCGTACAAAGCCGG	32

44[87]	1[87]	CGCCACCGCCAGAATACACCCGAGAAAGCG	30
44[119]	2[104]	CTAAAGTTCAGAACCGTTTGTGTAGCGGTCAC	32
44[151]	1[151]	CACAGACATTTTCAGCGCTGGTCCCTTATA	30
44[186]	1[183]	CGTCACCAGTAATGTACCGCTGGCCCTGGTTGAGT	35
45[37]	4[33]	ACGATTGGCCTCAGGAGGTTCCTCGTTGTTGTAGCAATACTT	42
45[72]	4[72]	TCATTAAAAGAACCACGAGGCCGAGTAAAAGA	32
45[104]	3[111]	TGAATTTACCTCAGAGGGTACGCC	24
45[136]	4[136]	CCACCCTCAGCCCTCAGTTTGCGTCGTGCCAG	32
45[168]	4[168]	AGGAACCCCAAACTACTTTCACCATCACTGCC	32
46[55]	0[41]	AAGTTTTAATAAACAGTGCCGTAAAGCACTA	31
46[87]	0[80]	GCTTTTGACCTATTAATCACCC	22
46[119]	0[104]	GCCACCCTAGGCTGAGGTCTATCAGGGCGATG	32
46[151]	0[144]	CAGGAGGTTAGCGGGCGTGGAC	22
46[186]	0[176]	ATAAGTATAGCAGTGCCGTCCAGTTTG	27
47[37]	2[33]	ACAGTGCCCGTACGGGGTCTGACGGGGTATGGTTGCTTTGAC	42
47[72]	2[72]	ATTTCGGAATGATACAGGAAGGGACCGCGCTT	32
47[104]	1[111]	GTATTAAGCCGTTCCAAGGGCGCT	24
47[136]	2[136]	GATTAGGATTTAGTACGGCAAAATTTGCCCCA	32
47[168]	2[168]	GGCGGATACCGGAATACGAGATAGGAGAGAGT	32

b) 5 nm design

Start	End	Sequence	Length
0[47]	42[27]	TAAAGCACTAAATCGGGCCGGCGACGCCACCAGAACC	37
0[71]	41[71]	AAGTTTTTAAGCGAAAACCGCCACTTAGCGTT	32
0[103]	41[103]	ATGGCCCAAAGTGTAGAACCGCCTCACCGGAA	32
0[143]	41[135]	GACTCCAACGTCAAAGCGCTGGTTATTATTCTTCAAGAGA	40
0[175]	41[167]	TTGGAACAAGAGTCCATTTGATGGCAGTTAATGCTCAGTA	40
0[205]	42[184]	GCCCGAGATAGGGTTTATAAATGTCAGTGCCTTGAGTA	38
1[21]	43[39]	TGACGGGGAAAAACCCTAAGCCGCCGCCAGCATTG	35
1[56]	43[63]	AGGGAAGATGGGGTCGGGTCAGAC	24
1[88]	43[96]	GCGCTGGCCTACGTGAAAATAAATC	25
1[120]	43[127]	GCGGTCCAGGCGAAAACGCAGTCT	24
1[152]	43[159]	AAATCCTGCTATTAATCATACA	22
1[184]	43[196]	AAAATCCCTGAGTGTTACTGGTAATAAGT	29
2[71]	39[71]	TAATGCGCGCTAAACAACAGAATCCAAAATCA	32
2[103]	39[103]	CGCTGCGCGACAGGAAACCATCGAAAGGCCGG	32
2[135]	39[135]	CTGATTGCTGCCCGCTTACCGCCACTCAGAGC	32
2[167]	39[167]	TTTTTCTTCCAGCTGCATAGGTGTGCAAGCCC	32
3[56]	42[56]	GAGCGGGACGCTACAGCCCCCTTACCTCAGAG	32
3[88]	42[88]	GGATTTTAGTAACCACATCAAAATCCCTCAGA	32
3[120]	42[120]	GCGCTCACCCTTCACCGAGACTCCGAAACATG	32
3[152]	42[152]	CTGTCGTGTTCACCAGGGGGTTTTGCCCCCTG	32
4[71]	37[71]	GTGAGGCCTTGCCTGAATTGACGGGTCACAAT	32

4[103]	37[103]	GCCAGAATCTTGCTGGCATTCAACCCAGCGCC	32
4[135]	37[135]	CTGGGGTGTCGACTCTTCATAGTTAGACGTTA	32
4[167]	37[167]	ACATACGACGAATTCGTACAACGCTTTTGCTA	32
5[56]	40[56]	AACATCACACCGAGTAAGAGCCAGAAGTTTGC	32
5[88]	40[88]	CTATCGGCCCTGAGAACCATTAGCTAGCAGCA	32
5[120]	40[120]	CCTGCAGGCCTAATGACCGCCACCCCCTCAGA	32
5[152]	40[152]	ACCGAGCTGCCGGAAGCAGGGATAATCACCGT	32
6[71]	35[71]	AGGAAAAAACACGACCCGTAGAAAAAGGAAAC	32
6[103]	35[103]	CCAGAACACAACAGAGAAGACTCCATACCCAA	32
6[135]	35[135]	GTCACGACCATTCGCCGAAAATCTTGTATCGG	32
6[167]	35[167]	GATTAAGTAAGGGCGAAAGGAATTAATTTCTT	32
7[56]	38[56]	CACCAGTCCGCTCATGTTTATTTTAAATTATT	32
7[88]	38[88]	ATTCTGGCATATTACCATGGTTTACGATTGAG	32
7[120]	38[120]	CAAAGCGCGTTGTAAAGTCTTTCCAGCGTAAC	32
7[152]	38[152]	CTGTTGGGTGGGTAACGTATGGGACTGTAGCA	32
8[71]	33[71]	GCACAGACCGAACCAGAAATAGCGCTAAT	29
8[127]	36[120]	CTTTCCGGCCTTTAATCCAAAAAA	24
8[135]	34[123]	CCAGCCAGCTCCGTGGGCTTGCAGGGAGT	29
8[167]	33[167]	ACGACAGTATGGGATACCACGCATCGAAAGAC	32
9[56]	36[56]	ATACCGAAAATATTTTGTTACCAGATACATAC	32
9[88]	36[88]	CAGAGGTGACCTGAAAATAACGGATTATTACG	32
9[152]	36[152]	GACCGTAATCGGCCTTCGAGGTGGCGAATAA	31
10[71]	31[71]	GCAACAGATCAATATCATAAAAAGCCATATT	31
10[135]	31[135]	GTCGGATTAAATTCGCGGTAAAATACGAAAGA	32
10[167]	31[167]	ATCAACATCATTTTTTGACTTTTTTCATCTTT	32
11[56]	34[56]	AACCCTCATGCCACGCTAATTGAGCAATAGCT	32
11[88]	33[100]	ATCAACAGAGGCGGTCACAAGAATTGAGT	29
11[96]	31[103]	TTGAAAGGATGAAAATACGATTTT	24
11[152]	34[152]	AATCAGCTTAAATGTTCAGCAGAACCGAT	29
12[71]	29[71]	TAACAACTTCGTATTAATTTTATCCGCGAGGC	32
12[103]	29[103]	GGAAGGTTATTTTAAAAAGATTAGCGGGAGGT	32
12[135]	29[135]	GGAAGATTATCTACAACGCGACCTACGGTCAA	32
12[167]	29[167]	CCGGTTGAAGTCTGGAGTATCATCACTTTGAA	32
13[56]	32[56]	TCGACAACAATAGATTAATAAACACAGGGAAG	32
13[88]	32[88]	CGTTATTAATCTAAAAAATAAGAAAGCAGCCT	32
13[120]	32[120]	TTTGAGAGGTATAAGCAACCTAAAACGTAATG	32
13[152]	32[152]	TGCCTGAGTAATCAGATAAAACACCATGAGGA	32
14[71]	27[71]	CCACCAGATATACTTCCATCGTAGAATCGGCT	32
14[103]	27[103]	AGTAACATTACCATATTCATCGAGCGGGTATT	32
14[135]	27[135]	ACCGTTCTCAACGCAATATTCATTGTGAATAA	32
14[167]	27[167]	GACAGTCAATATATTTTTCATCAAAGAACGAG	32
15[56]	30[56]	GTTTGGATAGGAGCGGTCTAAGAACTGAATCT	32
15[88]	30[88]	TTAGAACCTATCATTTCCGACTTGTTGCTATT	32
15[120]	30[120]	CTTTATTTAGCTGATAAGGCGCAGGCTCCATG	32
15[152]	30[152]	GAACCCTCAATCACCAACTGACCAGCCTGATA	32
16[71]	25[71]	GCGTAGATGATTGCTTAACAATAGAAAGTACC	32

16[103]	25[103]	TATTTGCAGCAGAGGCGTTCAGCTCCAGACGA	32
16[135]	25[135]	ACCAAAAACGAGCTGATTATACCATAAAACGA	32
16[167]	25[167]	AAGCCTCATAGTAGTAATTACCTTGGTAGAAA	32
17[56]	28[56]	ATTCGCCTTTTCAGGTCAATCAATGAATCATT	32
17[88]	28[88]	AAAATCGCCGTAAAACTCCAAGAAAACAAGCA	32
17[120]	28[120]	TTGGGGCGCATTATGACTCATTCAACCCAAAT	32
17[152]	28[152]	TCTACTAAGAGCATAAGAAACACCGAGTAATC	32
18[71]	23[71]	ATGAAACAAATCAATAGAATCGCCTACTAGAA	32
18[103]	22[104]	TTCATTTCCTGTAAATAAGCCAACGTTATACAAATTCTTAATCCAAAG	48
18[135]	23[135]	CATTTCGCCTGAATATAAGAGCAATAAAAACC	32
18[167]	23[167]	GAACGAGTAAATATGCCATAACGCAAGAAGTT	32
19[56]	26[56]	AGTACATAAACATCAAGAGAATATATAAGTCC	32
19[88]	26[88]	CCTTGCTTAATTACCTAATTCTGTAATGCAGA	32
19[120]	26[119]	CTTAATTGAAATGGTCTACGTTAAGTCAGGACG	33
19[152]	26[152]	CATGTTTTAGATTTAGTTATTACAATGCGATT	32
20[71]	22[56]	AACATAGCTTATATAAGTTAATTTCATCTTCT	32
20[103]	21[119]	TATTAATTTCCAATCGCAAGAAAAAATCAGGT	32
20[135]	22[119]	TGCTCCTTTGACTATTTTCAGAAAACGAGAATG	33
20[167]	22[152]	CAACAGGTCATCAAAATCATTGAATCCCCCTC	32
20[202]	22[184]	CGAGCTTCAAATTCAAATAAGCGTCCAATACTGCG	35
21[24]	22[26]	GTCTGAGAGACTACCTTTTGAAATACCGAC	30
21[56]	24[56]	AGGTTGGGGATAGCTTATCATAATATATTTAA	32
21[88]	24[88]	GATGCAAAAATTTTCCTCATATGCGCTCAACA	32
21[120]	24[119]	CTTTACCCTTGATAAGGACGACGACACTATCAT	33
21[152]	24[152]	GCGGATTGCAGGATTATTTTGCAACAAAAGGA	32
21[184]	23[196]	CGAAAGACGCGAACCATAGTAAAATGTTT	29
22[55]	19[55]	GACCTAAAACACCGGAAGATTAAGATGGAAAC	32
22[103]	19[87]	AACGCGAGAAAACTTTTTCAAATTTTAGTACTTAGAATGAATAA	44
22[118]	20[104]	ACCATAAGTTTACCAAGGTCATTTTTGCCGC	31
22[151]	19[151]	AAATGCTGAGAGGCGAGAGTAAGCTCAA	28
22[183]	19[191]	GAATCGTCGGGGGTAAGACCGGAATACGGTGTCTGGAAGT	40
23[27]	21[55]	TAAGGCGTTAAATAAGAATAATTTAATGGTTTTAACCTCCGGCTT	45
23[72]	21[87]	AAAGCCTGATATTTTACTATATGTAAATGCT	31
23[136]	21[151]	AAAATAGCTTAAACAGATAGTCAGAAGCAAA	31
23[168]	21[183]	TTGCCAGAATAAATATAGATTAAGAGGAAGCC	32
24[55]	17[55]	CAACGCCAAGTAATAAGAAAACAAAATAACGG	32
24[87]	17[87]	GTAGGGCGTAAAGTGAGCAAAAAGTTAC	28
24[118]	18[104]	AACCCTCGAAAAATCAATAACCTGTTTATTA	31
24[151]	17[151]	ATTACGAAACAACATTTGACCCATCAAT	28
24[187]	17[191]	ACATTCAACTAAAGTTGAGATGATTCCCATCCAATAAATCATAC	44
25[38]	20[24]	TTTTCGAGCCACATGTAACTTTTTTAACGCTGAGAAGAGTCAATAGTGAA	50
25[72]	20[72]	GACAAAAGTTAATTGATATGTGAGTCCTTGAA	32
25[104]	19[119]	CGACAATACCAGTATACGTGGATGGCTTAGAG	32
25[136]	20[136]	ACTAACGGGGCATAGTAATGCTGTCCTTTAAT	32
25[168]	20[168]	GATTCATCTGCAGATAAACTAAAGGCAAACTC	32
26[55]	15[55]	TGAACAAGGTAGAAACTTAACGTCTCCTGATT	32

26[87]	15[87]	ACGCGCCTTATCATAGAAATAGGAAGGG	28
26[118]	16[104]	TTGGGAACAAAGCTGCCCTGTAATACTTAAT	31
26[151]	15[151]	TTAAGAACTGACGAAGCTAAAATTTTTA	28
26[187]	15[191]	TTCAACTTTAATTGGGCTTGGCAAAATTATGCCTGAGTAATGTG	44
27[38]	18[34]	TTACGAGCATAAAAATAAGGAGAAACAATTAATTACATTT	40
27[72]	18[72]	GTCTTTCCTGTTTATCTGAATACCAGAAGATG	32
27[104]	17[119]	AAACCAAGAACAACATGAAGCTATATTTTCAT	32
27[136]	18[136]	GGCTTGCCCTGGCTCAAAAGGTGGATTAGATA	32
27[168]	18[168]	TAGTAAATCATTGTGAGCATTAACAATTCTGC	32
28[55]	13[55]	ACCGCGCCTCCGGTATAATTATCACAAACAAT	32
28[87]	13[87]	AGCCGTTGAACCTCTGCGGAAGCCCGAA	28
28[119]	14[104]	CAACGTAACCGGAACGAATTAATGCCGGATTG	32
28[151]	13[151]	TTGACAAGAACCGATCAATATAGGTCAT	28
28[187]	13[191]	GGCGCATAGGCTGATGAACGGGTGAGAAGAGAATCGATGAACGG	44
29[38]	16[34]	AGAAGGCTTACAATAGCACAATATAAAGATGAATATACAG	40
29[72]	16[72]	GTTTTAGCTTTATTTTTGAATAATAAGAAATT	32
29[104]	15[119]	TTTGAAGCTACCGCACCAATTGCGGGAGAAGC	32
29[136]	16[136]	TCATAAGGGAACCGGAGGATAAAATCGGTTGT	32
29[168]	16[168]	AGAGGACAGGCTGACCTAAATGCAAAGCAATA	32
30[55]	11[55]	TACCAACGAGTTACAAAGAGCCGTAAATATCA	32
30[87]	11[87]	TTGCACCCAATCCATATCTTTTTGGCAA	28
30[119]	11[127]	TTACTTAGAAGGCACCAAATATTTCGTTAATATTTTGTTA	40
30[151]	11[151]	AATTGTGAATACACAAAGCCCTTTGTTA	28
30[186]	11[191]	CAAAGTACAACGCGATTATGTCAATCAGGAACGCCATCAAAAA	43
31[38]	14[34]	CTAATTTGCCCTAACGAGAGACTTTATCATATTCCTGATT	40
31[72]	14[72]	ATTTATCCCAGCTACAAATCCTTTCAAAGAAA	32
31[104]	13[119]	TTGTTTAACTTAAATCAGTGAGGGTAGCTATT	32
31[136]	14[136]	GGCAAAAGTCGAAATCAGGCTATCGATATTCA	32
31[168]	14[168]	GACCCCCAGGAGATTTGCAAACAAAGGCCGGA	32
32[55]	9[55]	CGCATTAGTCAGAGGGTGAGAGCCCATTAAAA	32
32[87]	9[87]	TTACAGAGATAACCCAGTATTAAAGATAAAA	31
32[119]	12[104]	CCACTACGCGTCAAAAAATGTAAAAAATTTGA	32
32[151]	9[151]	AGTTTCCCGTCACCCGAGCGAGTGGCGGATT	31
32[186]	9[191]	AGAGGCTTTGAAACGAGGGCCTGTAGCTGGTGTAGATGGGCGC	43
33[38]	12[34]	CTGAACAAAGACGGGAGATGAACCTCCAATAGATAATACA	40
33[72]	12[72]	ATCAGAGAGAGAATAACTGGTCAGAGGAGCAC	32
33[123]	12[136]	TAAAGGCCGCTTTTGCGGGATATTAAACGATTAAATTCAAAAACA	45
33[168]	12[168]	AGCATCGGGGACTAAAAACCAATATATGTACC	32
34[55]	7[55]	ATCTTACCCGAACAAATGAATGGCGGCAGATT	32
34[100]	7[87]	TAAGCCCAATAATAAGAGCAACGCAATAGCGTAAGAAGGGAC	42
34[151]	7[151]	ATATTCGGCTTGCTTCAGGAAGTGCGCAA	29
34[186]	7[191]	CAATGACAACATGATACCGCCAGTTTGGGCCTCTTCGCTATTA	43
35[38]	10[34]	AGCAGATAGCGAAGCCCTAACATCGCAGCAGCAAATGAAA	40
35[72]	10[72]	CGAGGAAAGAAACAATCCAGCAGACACCGCCT	32
35[104]	7[119]	AAGAACTGAAAAGGAGCACCGCTTAAACCAGG	32
35[136]	10[136]	TTTATCAGTCGCTGAGGAACAAACAACAACCC	32

35[168]	10[168]	AAACAGCTACCATCGCGGTCACGTCAGCTTTC	32
36[55]	5[55]	ATAAAGGTGGAATAAGGAAATACCTTAGTAAT	32
36[87]	5[87]	CAGTATGAATTCATGCCAGCCACTCAAA	28
36[119]	6[104]	AAGGCTCCGTTTTGTCACGACGGCCAGTGTAT	32
36[151]	5[151]	TAATTTTATTTTCTGCCAGGGCCCGGGT	28
36[186]	5[191]	GAATAGAAAGGTCAACAGTGGATGTGCGTCATAGCTGTTTCCT	43
37[38]	8[34]	AAGACACCACGGCAACATTTTACATTTATTAGTCTTTAAT	40
37[72]	8[72]	CAATAGAATTAGCAAAAGTAATAAAATACGTG	32
37[104]	8[96]	AAAGACAAGCATGATTATAGCCGGCTGGTGAACCCTTCTG	40
37[136]	8[136]	GTAAATGATTCACGTTATTCAGGCATCGCACT	32
37[168]	8[168]	AACAACTTAACAACTATCGGTGCGAGGGGACG	32
38[55]	3[55]	CATTAAAGTGGGAATTAAAGAGTCTAGAATCA	32
38[87]	3[87]	GGAGGGAACCATTAGTGTTTTATTAAAG	28
38[119]	4[104]	GATCTAAACCTCAGAAGTGAGCTAACTCATAC	32
38[151]	3[151]	TTCCACATCATTTTCATAAAGGGGAAAC	28
38[186]	3[191]	TTTCGTCACCACCCATGTACTCACAATATCGGCCAACGCGCGG	43
39[38]	6[34]	TTGAGCCATTGTGAATTATTCTTTGATACATTTTGACGCT	40
39[72]	6[72]	CCAGTAGCAGGTAAATGTAGAAGAATTGCAAC	32
39[104]	5[119]	AAACGTCAAAGGGCGATAACCAAGCTTGCATG	32
39[136]	6[136]	CACCACCCGACAGCCCAGAGGATCTTTTCCCA	32
39[168]	6[168]	AATAGGAAGTACAAACTAATCATGTGCAAGGC	32
40[55]	1[55]	CTTTAGCGGGTCATAGGGCGCGTAAGAAAGGA	32
40[87]	1[87]	CCGTAATTTTCATACACACCCCGCTAGG	28
40[119]	2[104]	ACCGCCACAAGAGGCTGCCTGGCCCTGAGTCA	32
40[151]	1[151]	ACTCAGGGATTAGCTGAGACGCAGGCGA	28
40[186]	1[183]	GATATAAGTATATAAGTGCTTGGGCGCAAATCGGC	35
41[38]	4[34]	CGGCATTTTCTCAGACTGTTCCTCGTTGTCCATCACGCAA	40
41[72]	4[72]	TGCCATCTCAGTAGCGGGAGGCCGTATAATCA	32
41[104]	3[119]	CCAGAGCCCCAATGAACGGCATTAATTGCGTT	32
41[136]	4[136]	AGGATTAGAGGTTTAGTTCCAGTCTGTAAAGC	32
41[168]	4[168]	CCAGGCGGAGCCCGGAATTAATGATCCACACA	32
42[55]	0[48]	CCACCACCTTGAGGCAAGGTGCCG	24
42[87]	0[72]	GCCGCCATCACAAACACCATCACCCAAATC	30
42[119]	0[104]	AAAGTATTATGGAAAGACCGTCTATCAGGGCG	32
42[151]	0[144]	CCTATTTAGTAAGCGAGAACGTG	23
42[183]	0[176]	ACAGTGCCAGGAGTGTGTTCCAGT	24
43[40]	2[34]	ACAGGAGGCTCAGAGCACGTGGCGCTATGGTTGCTTTG	38
43[64]	2[72]	GATTGGCCTTGATATCCCTCAGAGGAGCGGGGCCGCGCT	39
43[97]	1[119]	CTCATTAAAGCCAGAACCACCGGCGGAGAGTTGCAGCAA	39
43[128]	2[136]	CTGAATTTACCGTTCCCGGAACCTTGCCCCAGGGCAACAG	40
43[160]	2[168]	TGGCTTTTGATGATACCGTATAAATGGTTCCGCAGGGTGG	40

c) 14 nm design labelled with Cy3

The following staples were modified at the 3’ end with a Cy 3 label. The start and end positions correspond to the original unmodified staple shown in S9a.

Start	End	Sequence	Length
26[55]	19[55]	TAAGTCCTCGAGCATGAGAGTCAATTAATGGA**TTT-Cy3**	32
27[168]	22[168]	TCGTCATAACAGTTCAGTGGCATCGATTCCCA**TTT-Cy3**	32
34[55]	11[55]	GCAAGAAACCTTTTTATAGAGCCGCAACAGTT**TTT-Cy3**	32
35[168]	14[168]	TTAGCCGGCGAACTGACGCGTCTGATTCGCAT**TTT-Cy3**	32
44[55]	1[55]	AGCATTGATGATATTCGCGCGTACAAAGCCGG**TTT-Cy3**	32
45[168]	4[168]	AGGAACCCCAAACTACTTTCACCATCACTGCC**TTT-Cy3**	32

d) 14 nm design modified with the ssDNA overhangs.

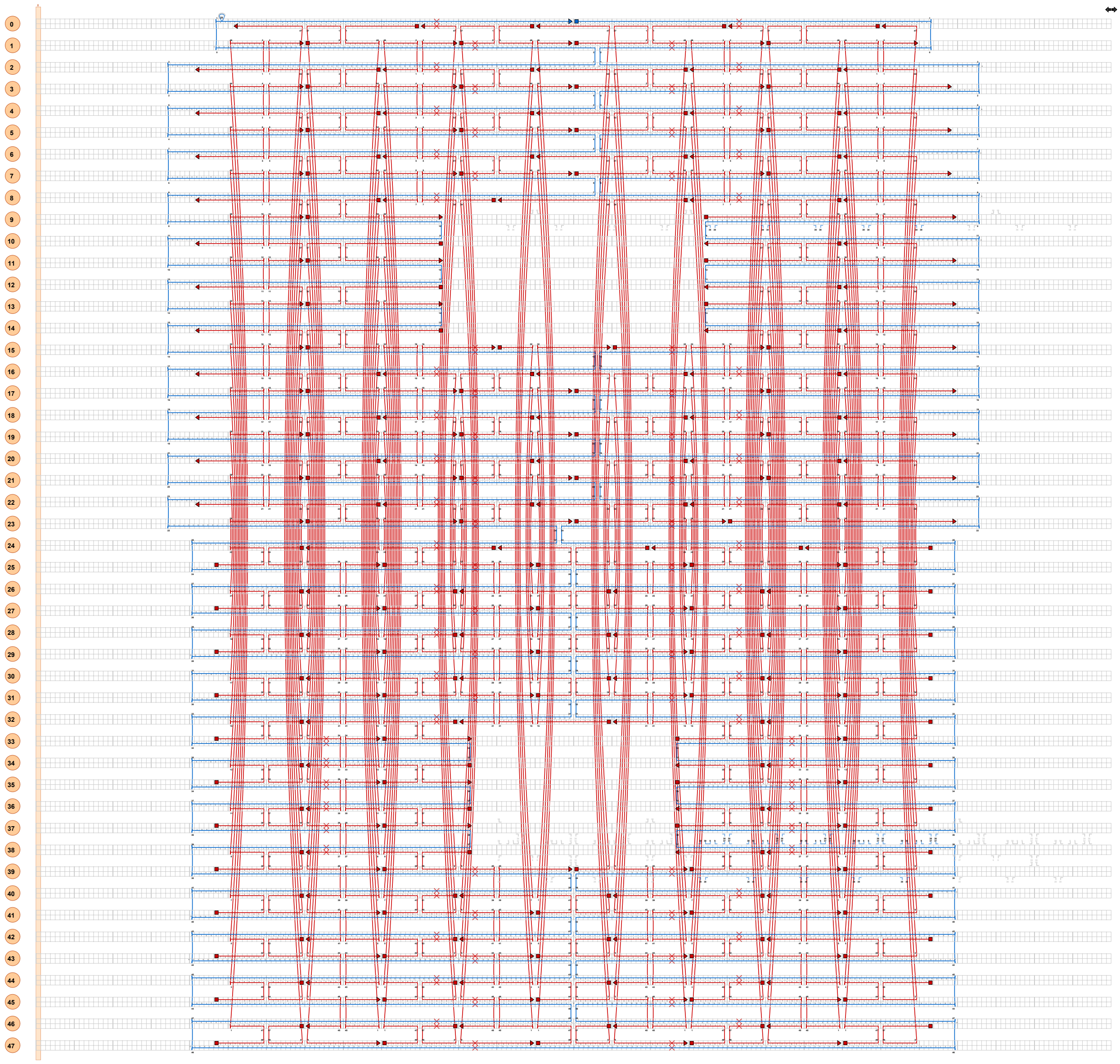
The following staples incorporated the ssDNA overhangs at the 3’ end (shown in bold). The start and end positions correspond to the original unmodified staple shown in S9a.

Overhang	Start	End	Sequence	Length
A	34[151]	12[139]	GACAGATGATCCGCGAGGGAACAAACGGC**TTTATAT**	36
B	37[72]	11[84]	ACATACATAGGAAACGGGTTATCTAAAAT**GGGCGCG**	36
C	34[151]	12[139]	GACAGATGATCCGCGAGGGAACAAACGGC**TTTAT**	34

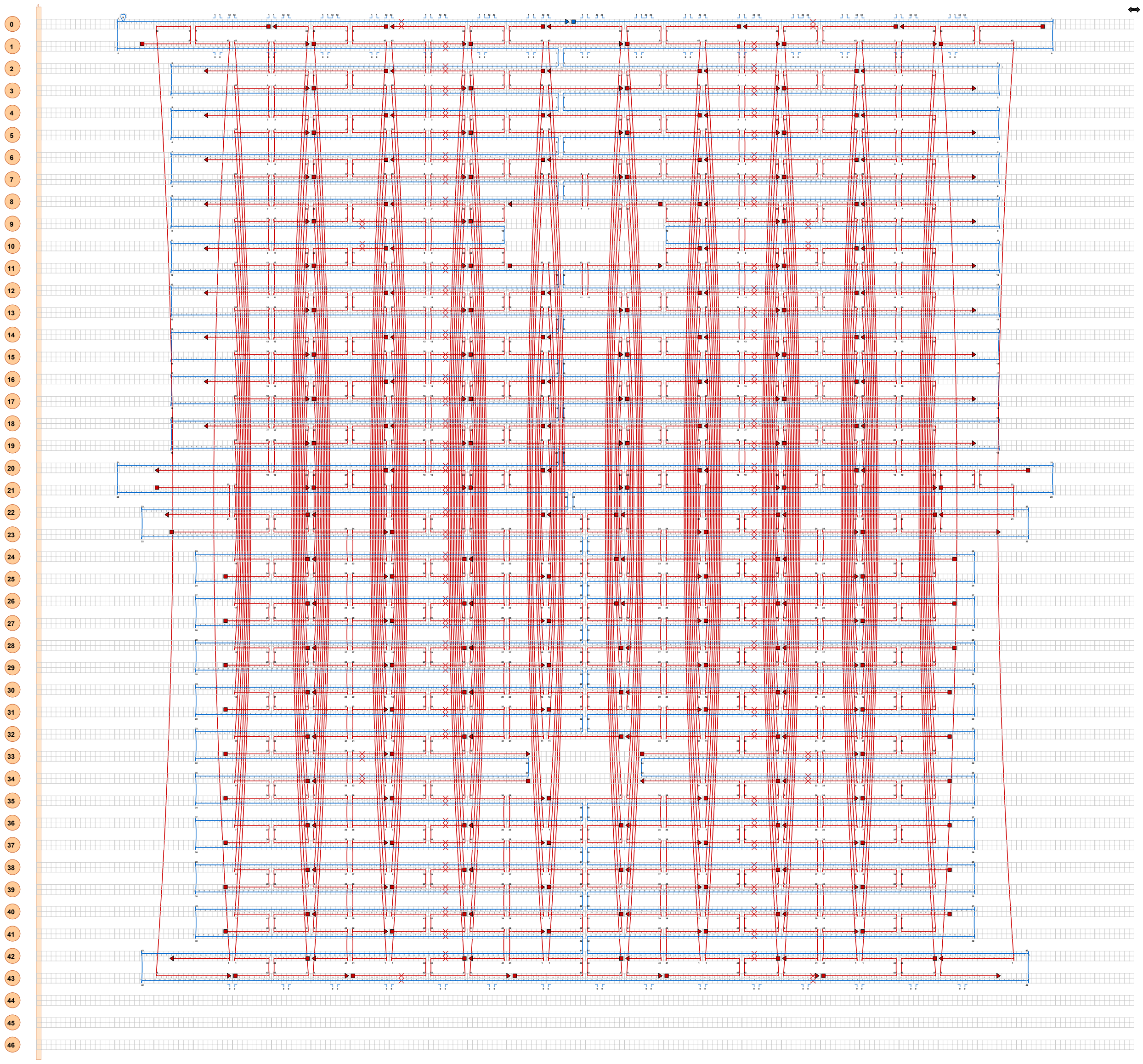
The sequences of the five preys are shown in the following table. The complementary overhang for each prey is indicated.

Overhang	Sequence	Length
A	$[T]_{23}$ATAT$[T]_{23}$	50
B	$[T]_{24}$GCG$[T]_{23}$	50
B	$[T]_{23}$CGCG$[T]_{23}$	50
C	$[T]_{24}$AT$[T]_{24}$,	50

14 nm pore design



5 nm pore design



9. Video showing ionic current and single molecule fluorescence detection of DNA origami nanopore trapping

Video 1. We demonstrate a clear correspondence between the drop in ionic current (shown in Figure 2b) and the single molecule fluorescence detection of trapping at the nanocapillary tip. Fluorescence imaging is performed at 200 fps and the ionic current is acquired at 100 kHz. The two are synchronised at 100 fps. The presence of the origami nanopore at the nanocapillary tip is indicated by the arrow. Scale bar in the ionic current animation: *Y* axis is ionic current (1 nA) and *X* axis is time (1 s).