

Supplementary Information For:

Self-Replication of Information-Bearing Nanoscale Patterns

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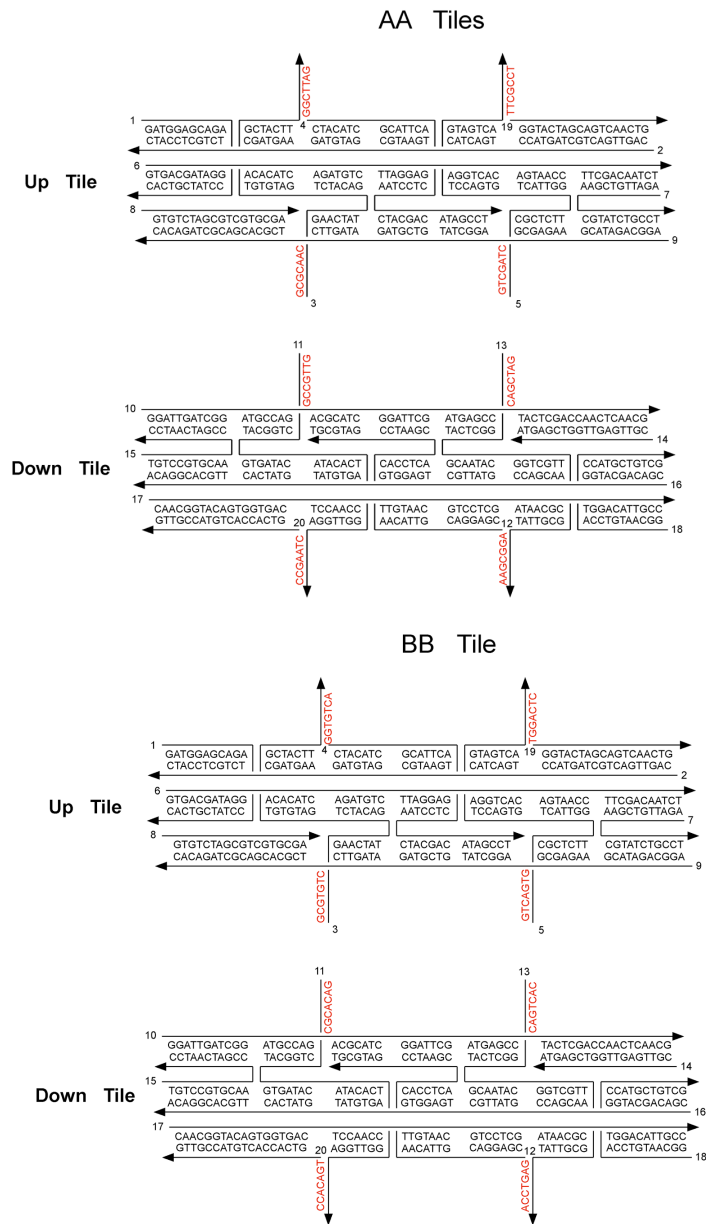
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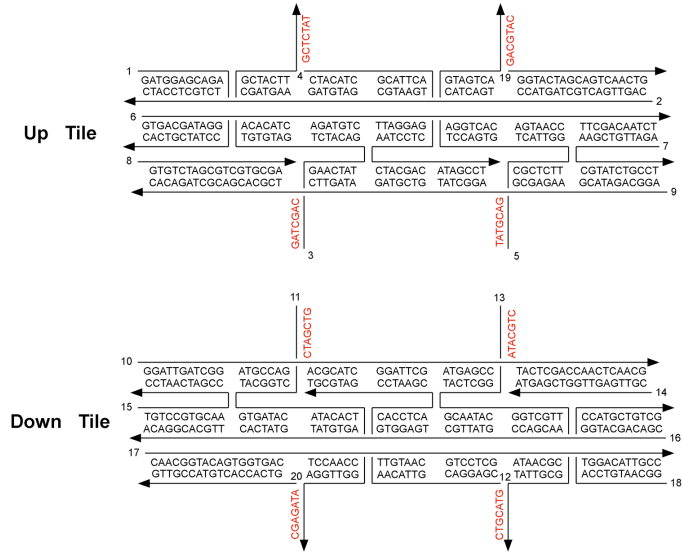
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S1. Sequences of BTX Tiles

Sequences of blunt tiles used in gel experiments. 'Up' tiles can be paired with 'Down' tiles. AA refers to A-type tiles, BB to B-type tiles, ICN4 to Initiator tiles.

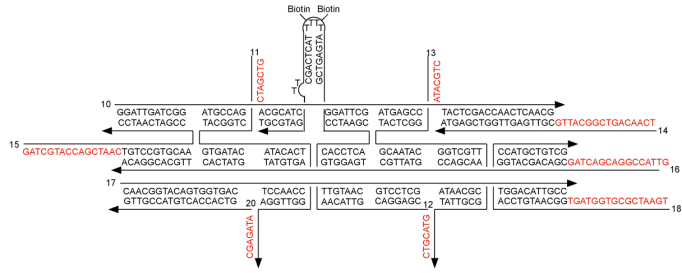


ICN4 Tile

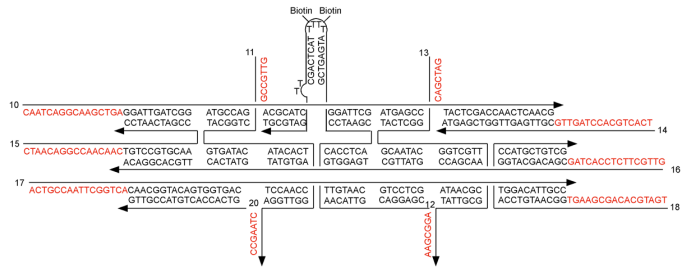


A-Type Seed Tiles with Biotin Loops for Imaging

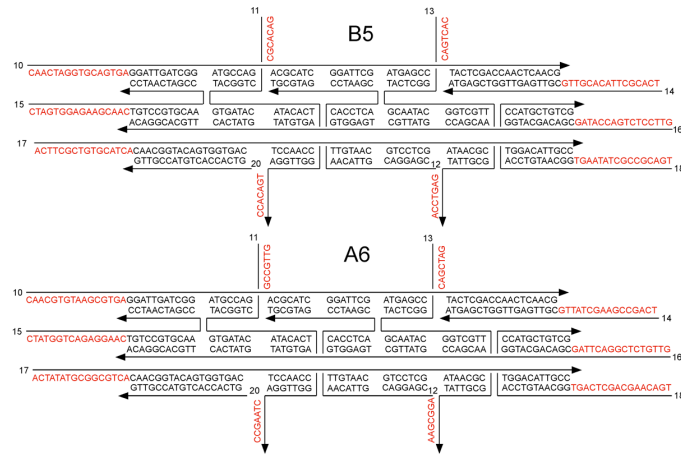
SEED Tiles A1(l1)-biotin



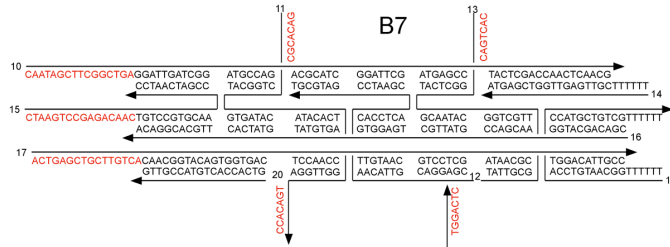
SEED Tiles A4-biotin



SEED Tiles (B5,A6)

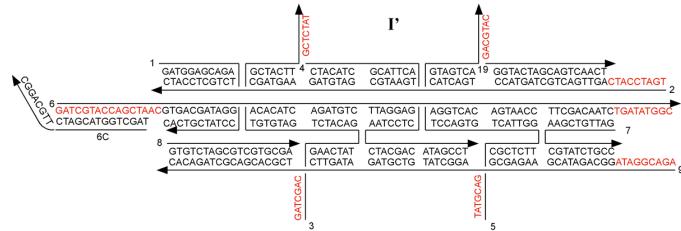


SEED Tiles (B7)



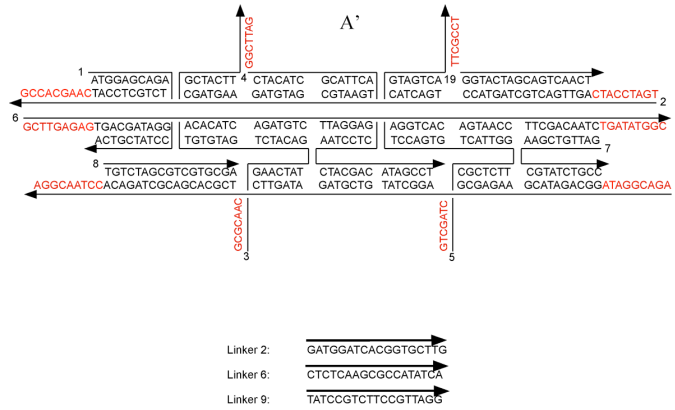
First Generation Tiles

First Generation

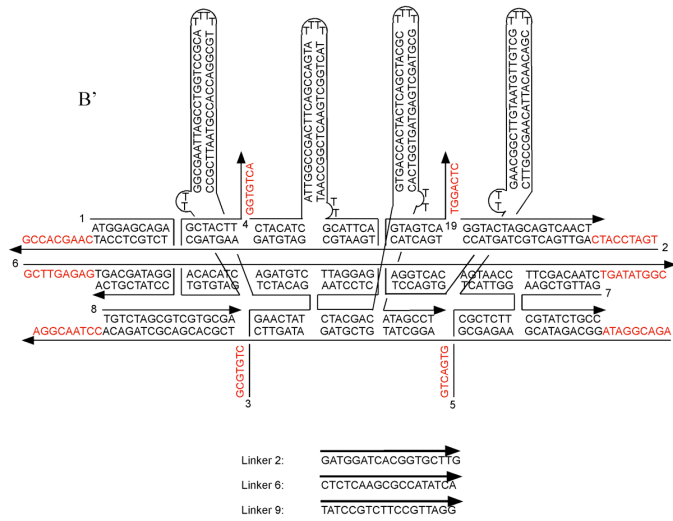


Fuel strand 6CF: GCCTGCAAGATCGTACCAAGTA
 Linker 2: GATGGATCACGGTGCCTG
 Linker 6: CTCTCAAGGCCATATCA
 Linker 9: TATCCGCTTCGCTAG

First Generation

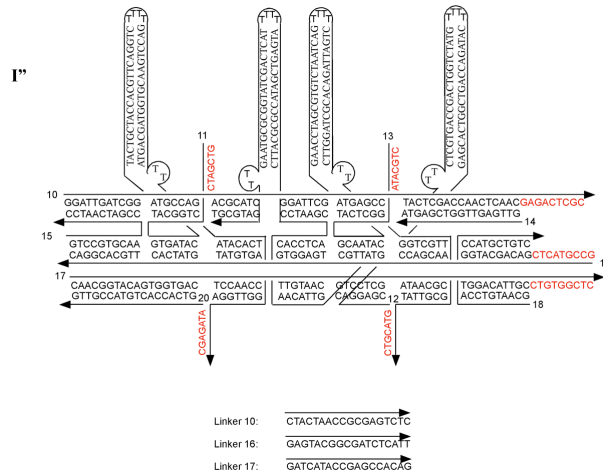


First Generation

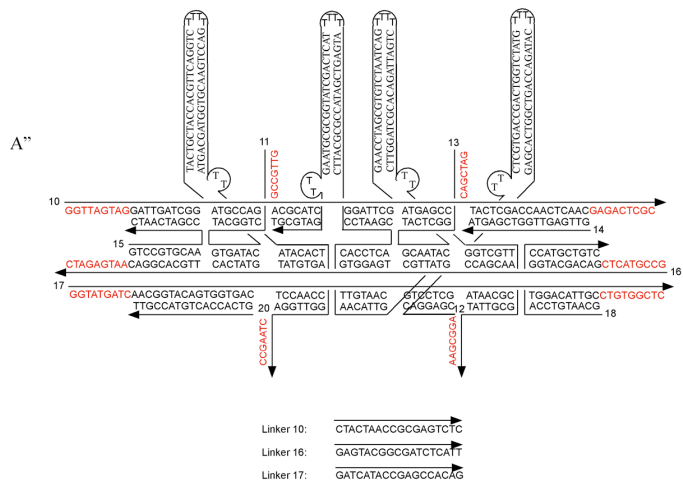


Second Generation Tiles

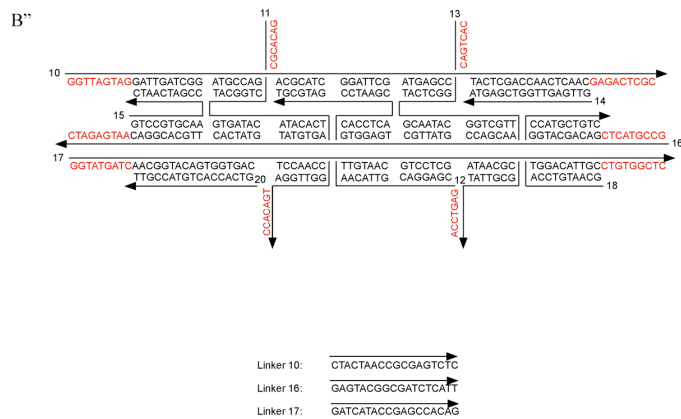
Second Generation



Second Generation

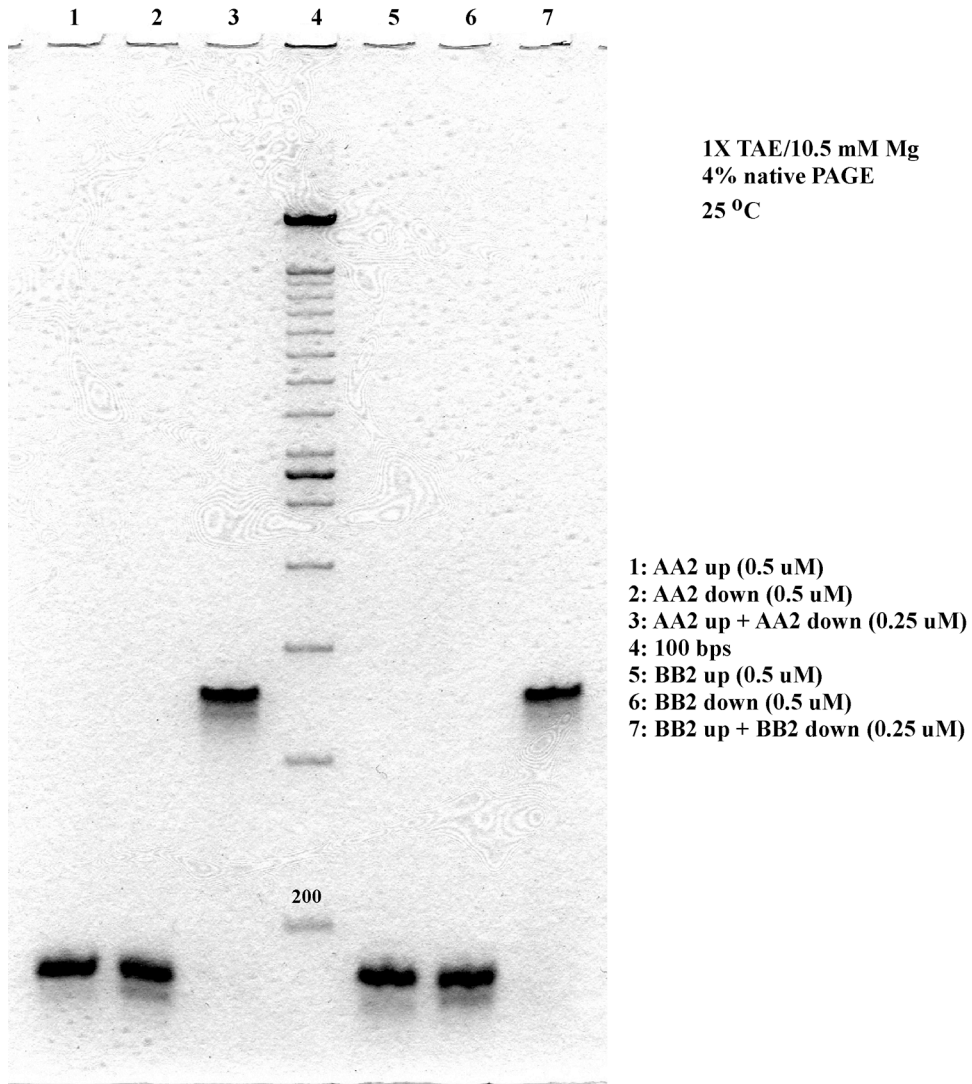


Second Generation



S2. Non-Denaturing Page Gel Showing Pairing of BTX Tiles with Complementary Lateral Cohesive Interactions

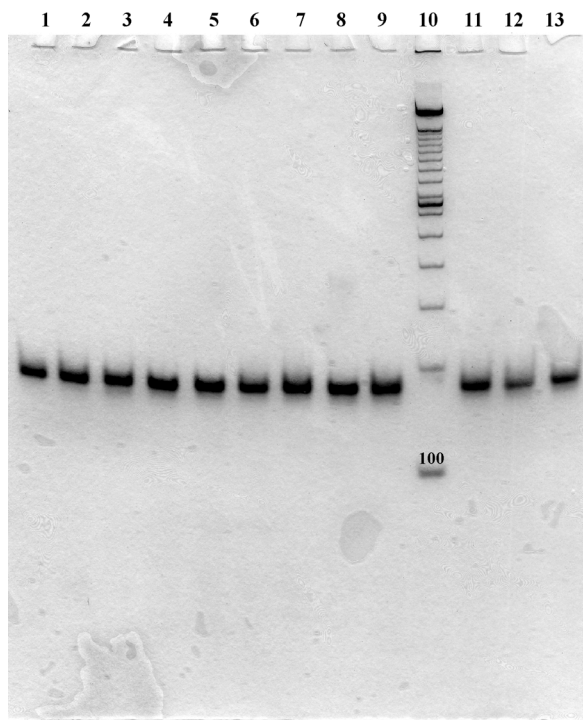
PAGE of A and B Tiles



This gel shows the successful assembly of two A-type tiles (lanes 1,2) and two B-type tiles (lanes 5,6). Lanes 3 and 6 show the cohesion of the up and down tiles. Lane 4 is a 100 nt pair marker. This gel is run at 25 °C.

**Gel Showing Lack of Cohesion of BTX Tiles
Lacking Complementary Lateral Cohesive Sticky Ends**

PAGE of I, A and B Tiles

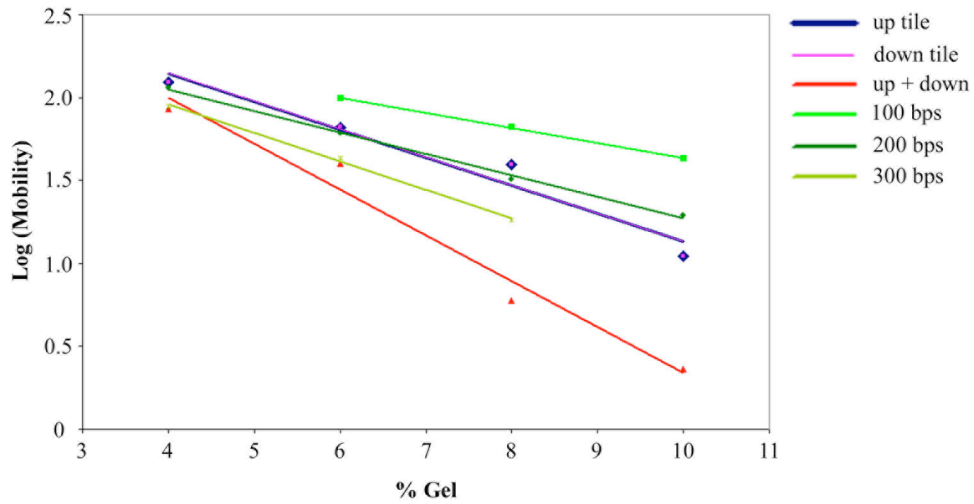


1X TAE/10.5 mM Mg
4% native PAGE
25 °C

- 1: ICN4 up (0.5 uM)
- 2: AA2 up (0.5 uM)
- 3: BB2 up (0.5 uM)
- 4: ICN4 up + AA2 down (0.25 uM)
- 5: ICN4 up + BB2 down (0.25 uM)
- 6: AA2 up + ICN4 down (0.25 uM)
- 7: AA2 up + BB2 down (0.25 uM)
- 8: BB2 up + ICN4 down (0.25 uM)
- 9: BB2 up + AA2 down (0.25 uM)
- 10: 100 bps
- 11: ICN4 down (0.5 uM)
- 12: AA2 down (0.5 uM)
- 13: BB2 down (0.5 uM)

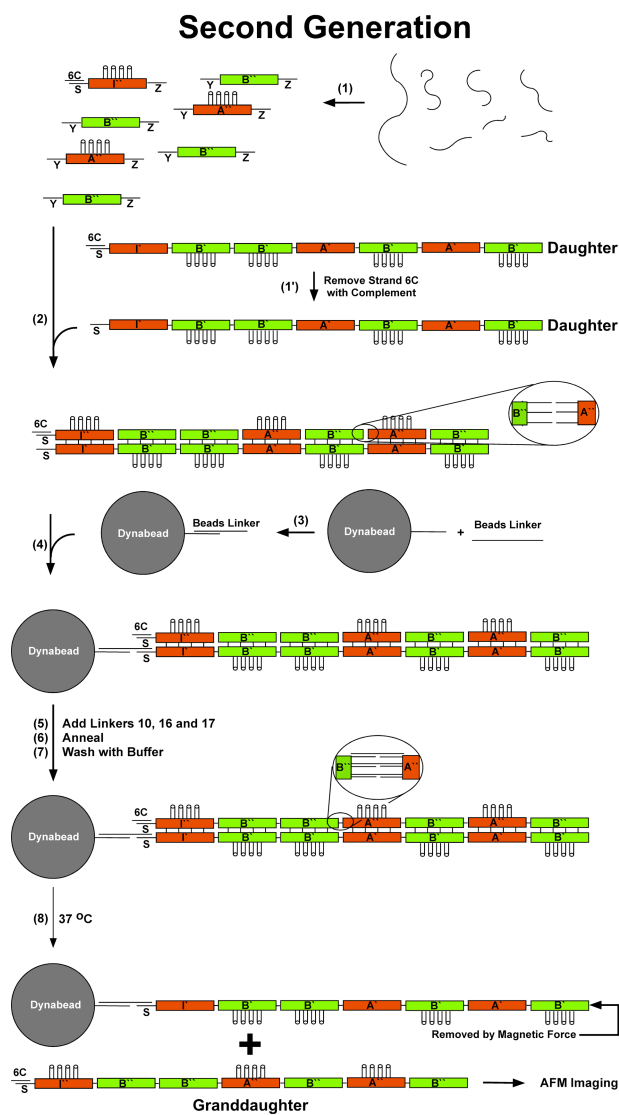
This gel shows that incorrect pairs do not bind to each other at 25 °C.

S3. Ferguson Plots of the ICN4 Species Used Here



The slope of the Ferguson plot is proportional to the friction constant of the molecule. It is clear that the two individual BTX tiles have similar friction constants, whereas their P6HB complex has a larger friction constant.

S4. Protocol To Produce the Granddaughter Molecules.



Replication of the Seed Pattern in the Second Generation. As in previous steps, the individual **A''** and **B''** tiles are assembled from their component strands. However, in this generation, we have chosen to put the hairpin markers on the **A''** tiles, rather than the **B''** tiles, in contrast to the first generation. The daughter tile has been flipped upside down here for clarity. The first step entails removing the cover strand from this daughter tile. The second step entails combining the daughter construct with the **A''**

and **B''** BTX tiles to form the P6HB complex. As in the first generation, the dynabead is prepared (step 3) and is combined with the P6HB complex (step 4). At this stage, the linker strands are added, annealed and washed with buffer (steps 5-7). The blowup following step 7 shows that the granddaughter molecule is now intact in the horizontal direction. Heating to 37 °C separates the two components of the P6HB complex. The dynabead, containing the daughter molecule is removed, and the granddaughter molecule is ready for AFM imaging.

[S5] Statistics for Producing Daughters and Granddaughters.

Three different preparations were made, and only the indicated species were examined. The process was uninterrupted from tile generation to AFM examination. The only purification was performed before preparation of tiles. Therefore, because the process was uninterrupted, we do not know the statistics of the seeds when examining the first generation, nor do we know either the statistics of the seeds or the first generation when examining the second generation.

Streptavidin is a multivalent protein, capable of binding as many as four different biotin molecules, and hence of confusing the results accordingly. Many 'aggregated molecules', such as those seen in the upper left panel of Figure 2b may suffer from this artifact. Whereas replication takes place in the absence of streptavidin, this is an artifact creating a worst case scenario for observation of seeds, but not for the actual replication process.

Seeds using streptavidin as marker

Right pattern (correct length): 108 (80%)

Wrong pattern (correct length): 27(20%)

Molecules of various lengths (including correct length): 259

First Generation using long hairpin as marker

Right pattern (correct length): 19 (70.4%)

Wrong pattern (correct length): 8 (29.6%)

Molecules of various lengths (including correct length): 63

Second Generation using long hairpin as marker

Right pattern (correct length): 5 (31.3%)

Wrong pattern (correct length): 11 (68.7%)

Molecules of various lengths (including correct length): 164

