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Programmable disorder in random DNA tilings

Supplementary information (part I of II)

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S1 Materials and methods

S1.1 Sample preparation

Single-stranded M13mp18 DNA (scaffold strand) was purchased from Bayou Biolabs (Catalog # P-107) at 1 g/L in 1× TE buffer (10 mM Tris-HCl, 1 mM EDTA, pH 8.0). The concentration of scaffold strand was calculated based on DNA UV absorbance measurement at 260 nm using NanoDrop2000 (Thermo Scientific). Staple strands were purchased unpurified from Integrated DNA Technologies in 1× TE buffer (pH 8.0) at 100 μM each.

Individual DNA origami tiles for creating unbounded arrays were prepared with 50 nM scaffold strand and 75 nM staple strands in 1× TE/Mg^{2+} (1× TE buffer containing 12.5 mM magnesium acetate). Individual DNA origami tiles for creating finite arrays with designed size were prepared with 10 nM scaffold strand and 75 nM staples in 1× TE/Mg^{2+} buffer. In both protocols the scaffold and staple mixtures were kept at 90 °C for 2 minutes and annealed from 90 to 20 °C at 6 sec/0.1°C.

Unbounded arrays were constructed using 1) an overnight anneal from 40 to 30 °C at 5 min/0.1°C and then from 30 to 20 °C at 10 sec/0.1°C (examples include the arrays shown in Figs. 2 to 5), 2) a two-day anneal from 40 to 30 °C at 25 min/0.1°C and then from 30 to 20 °C at 10 sec/0.1°C (examples include the array shown in Fig. S19), or 3) a one-week anneal from 40 to 30 °C at 60 min/0.1°C and then from 30 to 20 °C at 30 min/0.1°C (examples include the arrays shown in Figs. S20 and S21).

Prior to mixing different types of tiles for creating finite arrays with designed size, a 10-fold excess (relative to the concentration of staple strands) of a full set of 44 negation strands (sequences listed in Table S6) were added to each type of DNA origami tiles and quickly cooled down from 50 to 20 °C at 2 sec/0.1°C. Different types of tiles were then mixed together and annealed from 50 to 20 °C at 2 min/0.1°C.

S1.2 AFM imaging

Samples for AFM imaging of unbounded arrays were prepared by diluting origami to 5 nM (monomer concentration) in 1× TE/Mg^{2+} buffer. After dilution, 40 μL of sample was deposited onto freshly-cleaved mica (SPI Supplies, 9.5 mm diameter, LOT # 1170203). After 30 seconds the solution was removed by sucking up all the liquid that comes off in a single thumb-up movement while keeping the pipette attached to and almost perpendicular to the mica surface. After that, 80 μL of 1× TE/Mg^{2+} buffer was added onto the mica and the sample was imaged.

Samples for AFM imaging of individual DNA origami tiles and finite arrays with designed size were prepared by diluting origami to 1 nM (single tile or target finite shape concentration) in 1× TE/Mg^{2+} buffer. The following steps were the same as for unbounded arrays, except after removing the solution, the mica surface was washed three times with 40 μL TE buffer containing 10 mM $MgCl_2$ and 10 mM NaCl, by performing 10 down-and-up thumb movements for each wash. Compared to unbounded arrays, the finite arrays had a much larger excess of short strands (including a 5 times higher ratio of staples to scaffold and an addition of negations strands at 10 times the concentration of staples), and thus the washing step was used to remove the short strands and provide a cleaner background for imaging.

AFM images were taken in tapping mode in fluid on a Dimension FastScan Bio (Bruker) using FastScan-D tips (Bruker). Typical scanning parameters were: scan rate = 5 Hz, lines = 512, amplitude set point = 30-50 mV, drive amplitude = 180-240 mV, drive frequency = 110 Hz, integral gain = 1, proportional gain = 2.

S1.3 Syntax of the programming language for random DNA tilings

- Defining patterns on a tile:
  $\boldsymbol{tile = Connect[((x_1, y_1),\ (x_2, y_2))\ @\ (cx_1, cy_1), \ldots]}$
  (x_i, y_i) defines the start and end points of a line.
  (cx_i, cy_i) defines the center of an arc.
  When @ is missing, the points are connected by a straight line.

- Defining a grid:
  $\boldsymbol{grid[(i,j),\ tile]} = [\text{If } \boldsymbol{cond_1(i,j),\ tile\ @\ orient_1; \ldots}]$
  (i, j) indicates a location on the grid.
  $cond_i$ defines a set of specific locations on the grid, as a function of (i, j).
  $orient_i$ defines the orientation of a tile at $cond_i$ on the grid.
  The default grid is $grid[(i,j),\ tile] = [tile\ @\ 0 \text{ degree}]$, which has the same orientation of tiles at all locations.

  $tile$ can be replaced by a set of tiles $\boldsymbol{tile[1, 2, \ldots, n]}$, in which case each $cond_i$ will be associated with a subset of tiles $\boldsymbol{tile[t_1, t_2, \ldots]}$, $t_i \in \{1, 2, \ldots, n\}$.

- Defining a random choice of tile orientations:
  $\boldsymbol{tile\ @\ RandomChoice[(p_1, p_2, \ldots) \rightarrow (orient_1,\ orient_2, \ldots)]}$ $(\sum p_i = 1)$
  $orient_i$ defines an orientation of the tile.
  p_i is the probability of $orient_i$.
  The default probability is $1/n$, where n is the total number of choices.

- Defining a random choice of tile types:
  $\boldsymbol{RandomChoice[(p_1, p_2, \ldots) \rightarrow (tile_1\ @\ orient_1,\ tile_2\ @\ orient_2, \ldots)]}$ $(\sum p_i = 1)$
  $orient_i$ defines an orientation of $tile_i$.
  p_i is the probability of $tile_i\ @\ orient_i$.
  The default probability is $1/n$, where n is the total number of choices.
  The default orientation is 0 degree.

- Defining a random array:
  $\boldsymbol{array = tile\ @\ RandomChoice\ @\ grid}$

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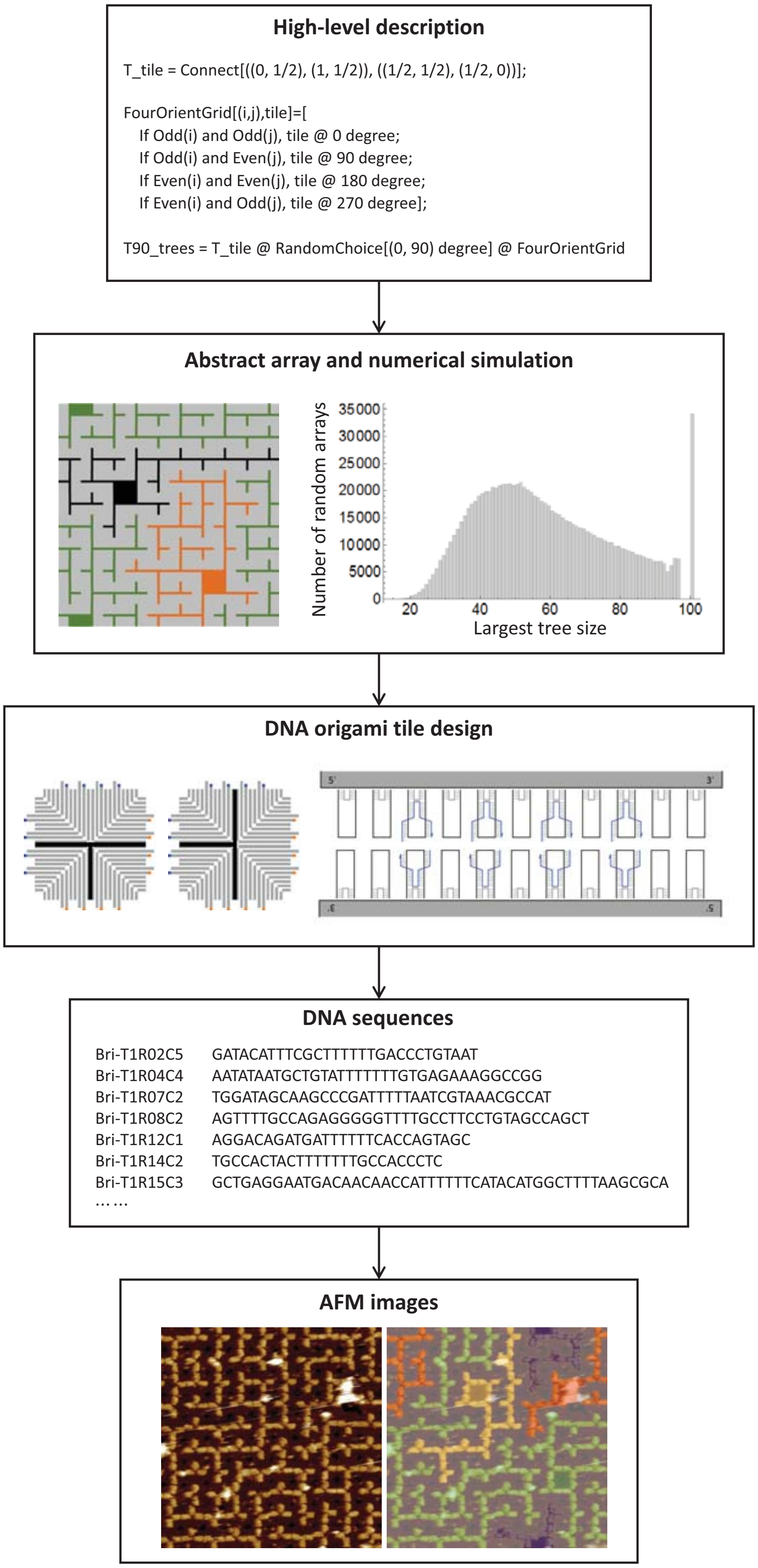

Figure S1: **Automated design steps for random DNA origami arrays.**

S2 Square DNA origami tiles

S2.1 Scaffold path design

We proposed several design principles for a DNA origami shape that could be used to implement Truchet tiles: First, the origami tiles should be symmetric on all four sides when rotated in the two-dimensional plane of the tile, such that it can adopt an unbiased choice of any of the four orientations when self-assembled into an array. Second, the continuous surface area of the origami tile should be maximized, such that a wide range of Truchet patterns can be created without leaving out many pixels (a pixel refers to the 5' or 3' end of each staple, because it is commonly used as an attachment site for other molecules). Third, the staples near the edges of the square shape can be modified to obtain weak tile-tile interactions using stacking bonds[1,2] or short sticky ends, such that when the tiles are binding to each other, sufficient reversibility can be provided and kinetic traps from spurious interactions can be avoided. Lastly, the origami tile should be as flat and rigid as possible, such that when the tiles interact with each other, they do not have a preferred three-dimensional configuration and the formation of large two-dimensional arrays will be encouraged.

We considered three options for a scaffold path that is rotationally symmetric (Fig. S2), and chose the one with the most continuous surface area (Fig. S2c).

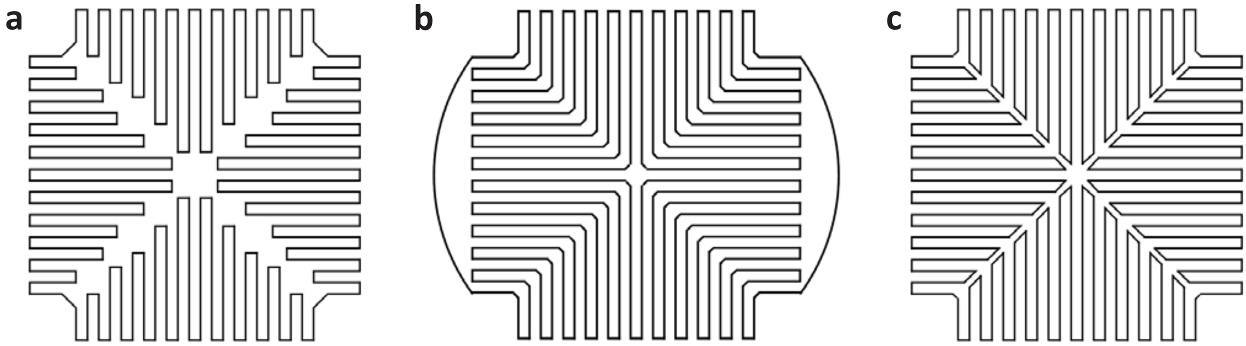

Figure S2: **Three designs of scaffold folding paths for a square DNA origami tile that is symmetric and allows stacking bonds on all four sides. a,** A scaffold path that fills in four isosceles right triangles sequentially, with scaffold crossovers at the end of each helix row both near the interior edges and exterior edges of the triangles. The length of each helix row is an integer number of turns plus half a turn. The disadvantage of this design is the small holes near the diagonals, which result in discontinuous surface area and may lead to insufficient rigidity of the origami tile. **b,** A scaffold path that fills in four square-shaped quadrant sequentially. The disadvantage of this design is the long scaffold loops connecting the adjacent corners of the square, which may interfere with interactions between tiles. **c,** A scaffold path that fills in four isosceles right triangles sequentially, with scaffold crossovers at the end of each helix row near the exterior edges of the triangles, and short single-stranded scaffold loops near the interior edges. This design allows an arbitrary number of base pairs in each helix row and thus continuous surface area of the origami tile.

S2.2 Single-stranded domain length calculation

Classic DNA origami designs require each row of helix to consist of an integer number of blocks, and each block is a helix turn with 10 to 11 base pairs.[3] In contrast, our scaffold path allows an arbitrary number of base pairs in each helix row by introducing short single-stranded scaffold loops at the locations where the scaffold makes a turn from one helix to another. This approach makes it possible for the four isosceles triangles to be closely composed together in the square shape.

The use of single-stranded domains in scaffold loops and also in staples bridging between the triangles requires careful design of the DNA origami: the same distance in the two-dimensional plane of the square origami tile could correspond to single-stranded lengths that differ by several bases. If these lengths are not properly chosen, it would strain the DNA at some locations and result in undesired twist of the origami. To resolve this challenge, we developed a three-dimensional model, at the level of each base pair, for calculating the lengths of single-stranded domains in staple bridges and scaffold loops. Coordinate locations of where each base joins the backbone were calculated and the Euclidean distances between all pairs of coordinate locations in staple bridges and scaffold loops were used to determine the lengths of single-stranded domains, assuming 0.4 nm for each nucleotide in a relaxed single strand. When calculating the lengths of single-stranded domains in staple bridges, we adjusted the distance between the center of the square to the central vertex of each isosceles triangle to make sure that the four triangles were closely composed together, but not too close to allow overlap of any base pairs in the adjacent triangles. Taking a side view from a corner of the square to its opposite corner, looking at the single-stranded bridges along the diagonal, the three-dimensional model also helped us to identify that the staple bridges had roughly balanced orientations within the 2 nm height of the double helices and the adjacent triangles should be well aligned within the two-dimensional plane of the square.

We first calculated the total number of rows in each of the four isosceles right triangles composing the square, and the number of base pairs in each row of the double helix. Then we calculated the coordinate locations of where each base joins the backbone, with the center of the square being $(0, 0, 0)$. We assumed that the length of each base pair in a double helix is 0.34 nm and the height is 2 nm. We used 1.5 turns standard spacing of staple crossovers, which resulted in a 1 nm gap between two adjacent helices. We deleted 1 base pair in every three columns of staples to apply twist correction to the origami, which resulted in 10.44 bp per helix turn thus $360°/10.44$ angle between adjacent bases on the same strand. In each two-dimensional plane of a base pair, we assumed 150 degree from the center of the helix axis to the two locations where the scaffold and staple bases join the backbone. Lastly, we calculated the Euclidean distances between all pairs of coordinate locations of where each base joins the backbone in staples connecting two sides of the seams and in scaffold connecting two adjacent helix rows (Fig. S3).

Step 1: Calculate the number of base pairs in each row of double helix

- The length of the shortest row of double helix: $I_1 = 11.3$ nm
- The total number of rows with increasing length in each of the four isosceles right triangles composing the square: $R = 11$
- The number of base pairs in the i th row of double helix:

$$\begin{aligned} A_i &= \frac{I_1 + (1+2)\text{ nm} \times (i-1)}{0.34\text{ nm/bp}},\ 1 \le i \le R \\ A_i &= A_{2R+1-i},\ R+1 \le i \le 2R \end{aligned}$$

Step 2: Calculate the locations of where each base joins the backbone

- The distance between the center of the square to the central vertex of each of the four triangles: $G = 1.42$ nm. (This adjustable parameter makes the four triangles fit tighter or looser.)
- The length of the side of the square:

$$W = 2 \times (I_1 + G) + (1+2)\text{ nm} \times (2R-1)$$

- The coordinate location of the **center** of the square is $(0, 0, 0)$.

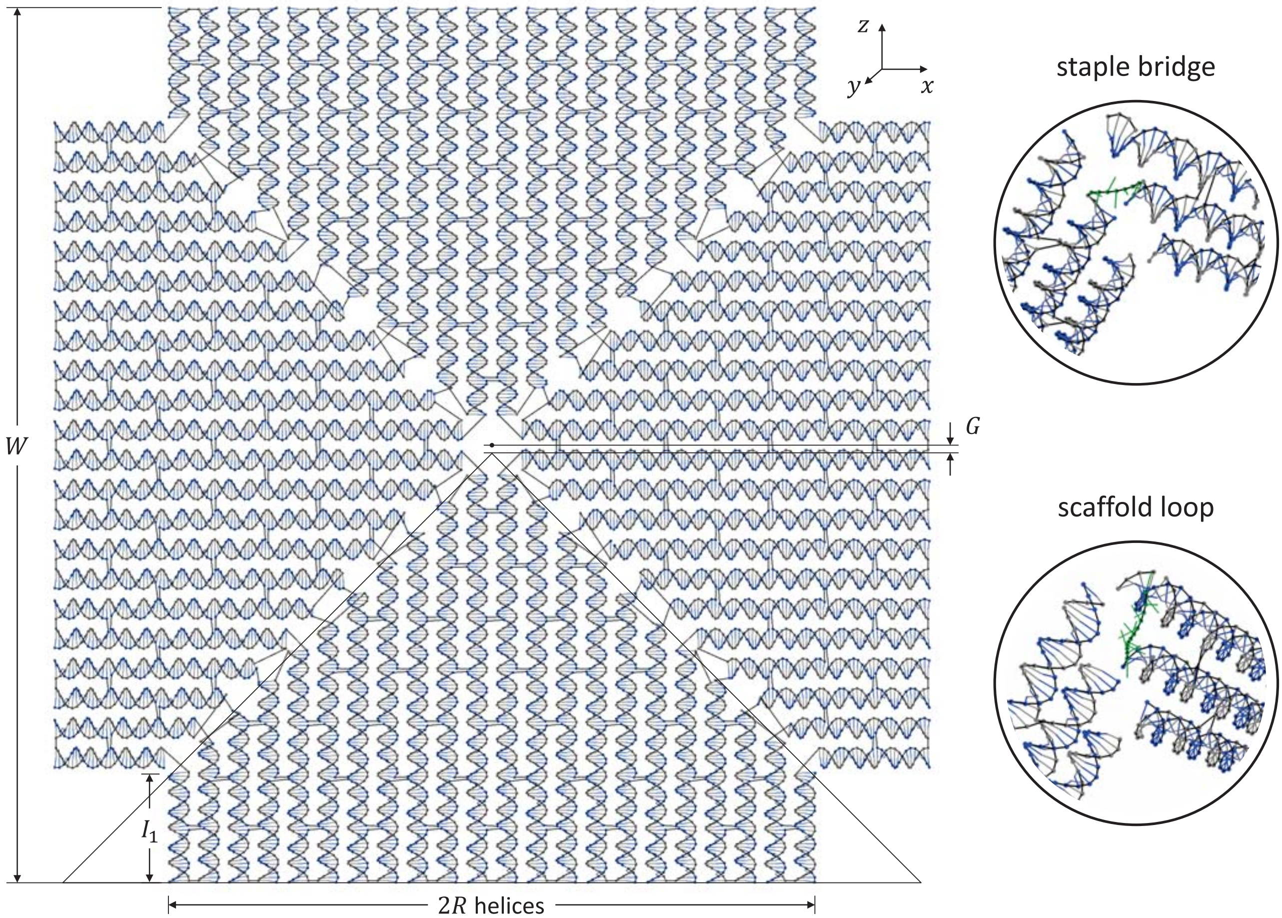

Figure S3: **A three-dimensional model for calculating the lengths of single-stranded domains in staple bridges and scaffold loops.**

- The coordinate location of the **helix axis** in the two-dimensional plane of the j th base pair in the i th row in the first triangle: $C_{1,i,j} = (cx, cy, cz)$

$$
\begin{aligned}
cx &= -\frac{W}{2} + (I_1 + G) + (1+2)\ \text{nm} \times (i-1) \\
cy &= 0 \\
cz &= -\frac{W}{2} + 0.34\ \text{nm/bp} \times j
\end{aligned}
$$

- The coordinate location of where the **scaffold base** joins the backbone in the two-dimensional plane of the j th base pair in the i th row in the first triangle:

$$
\begin{aligned}
SC_{1,i,j} &= (1, \theta_{1,i,j}, 0)\ \text{transform from Cylindrical to Cartesian coordinate}\ + C_{1,i,j} \\
\theta_{1,i,j} &= 0^\circ + (j-1) \times \frac{360^\circ}{10.44\ \text{bp/turn}},\ \text{if } i \text{ is odd} \\
\theta_{1,i,j} &= 180^\circ + (j-1) \times \frac{360^\circ}{10.44\ \text{bp/turn}},\ \text{if } i \text{ is even}
\end{aligned}
$$

- The coordinate location of where the **staple base** joins the backbone in the two-dimensional plane of the j th base pair in the i th row in the first triangle:

$$\begin{aligned} ST_{1,i,j} &= (1, \theta_{1,i,j}, 0) \text{ transform from Cylindrical to Cartesian coordinate } + C_{1,i,j} \\ \theta_{1,i,j} &= (0-150)^\circ + (j-1) \times \frac{360^\circ}{10.44 \text{ bp/turn}}, \text{ if } i \text{ is odd} \\ \theta_{1,i,j} &= (180+150)^\circ + (j-1) \times \frac{360^\circ}{10.44 \text{ bp/turn}}, \text{ if } i \text{ is even} \end{aligned}$$

- In the other three triangles, each coordinate location $C_{k,i,j}, SC_{k,i,j}$ and $ST_{k,i,j}$, where $k = 2$, 3 and 4, is in format (x, y, z) with the following calculations:

$$\begin{aligned} (x_{k,i,j}, z_{k,i,j}) &= (x_{k-1,i,j}, z_{k-1,i,j}) \text{ rotate } 90^\circ \\ y_{k,i,j} &= y_{k-1,i,j} \end{aligned}$$

Step 3: Calculate the lengths of single-stranded domains in staple bridges and in scaffold loops

- The length of the i th staple bridge, in nucleotides, is

$$\frac{\text{Euclidean distance between } ST_{2,i,A_i} \text{ and } ST_{1,2R+1-i,A_i}}{0.4 \text{ nm/nt}} - 1$$

  Staple bridges = {7, 5, 4, 7, 6, 4, 7, 3, 5, 8} nt

- The length of the scaffold loop between the i th and $(i+1)$ th row of helix, in nucleotides, is

$$\frac{\text{Euclidean distance between } SC_{1,i,A_i} \text{ and } SC_{1,i+1,A_{i+1}}}{0.4 \text{ nm/nt}} - 1, \; i \text{ is even}$$

  Scaffold loops = {12, 8, 11, 13, 8, 8, 13, 11, 8, 12} nt

  Note: an earlier version of the 3D model did not take twist correction into consideration, and gave us slightly different numbers for the scaffold loops:

  Scaffold loops = {11, 8, 13, 10, 8, 8, 10, 13, 8, 11} nt

  After comparing the two sets of numbers, we decided that the difference was small enough that we were comfortable using the non-optimal numbers to avoid the cost for re-ordering all staple strands.

- The length of the scaffold bridge between the two adjacent triangles, in nucleotides, is

$$\frac{\text{Euclidean distance between } SC_{2,1,A_1} \text{ and } SC_{1,2R,A_{2R}}}{0.4 \text{ nm/nt}} - 1$$

  Scaffold bridge = 8 nt
  The scaffold bridges were adjusted to {10, 10, 10, 11} nt such that the full length of M13 scaffold (7,249 nt) was used.

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S2.3 Staple design

It is known that the choice of double-stranded domain lengths in staples or other short strand building blocks could affect the yield and stability of DNA nanostructures.[4,5] We explored two designs of bridge staples (colored in green in the Cadnano[6] diagrams shown in Fig. S4). One design that we referred to as the "strong-weak" bridge design used longer domains on one side of the seams and shorter domains on the other. The motivation for this design was to reduce the possibility that scaffold loops and staple bridges get tangled and geometrically trapped in an undesired conformation during the process of self-assembly. But the cost of this design was that the connection between the adjacent triangles could be weak, and we observed that some locations along the seams were ripped open during imaging (Fig. S5). The other design that we referred to as the "strong-strong" bridge design used sufficiently long domains on both sides of the seams, such that the four triangles were brought together with a stronger connection. Our results with the second design suggested that scaffold loops and staple bridges were able to form without interfering with each other, even when the binding of bridge staples on both sides of the seams occurred at similar temperature during anneal (Fig. S6). The "strong-strong" bridge staple design was then used in all DNA origami tiles.

Edge staples (colored in brown in Fig. S4) were designed with no staple crossovers at the end of each helix row, allowing relaxed edges in which blunt ends are free to adopt normal groove angles and stacking interactions between tiles are encouraged.[1] In contrast, if the edge staples are designed with staple crossovers, the scaffold and staple crossovers will pull the phosphates 180° away from each other in the blunt ends and result in weakened stacking interactions.

Interior staples (colored in purple in Fig. S4) were designed with the locations of 3' and 5' ends following a hexagonal grid near the same surface of the square tile, allowing these locations to be used as attachment sites for other molecules, or as extension sites for creating surface modifications such as double-stranded staple extensions. Note that the interior staples adjacent to the bridge staples may not satisfy this criterion. Twist correction was applied by deleting 1 base pair (indicated as red crosses in Fig. S4) in every three columns of staples.[1,7]

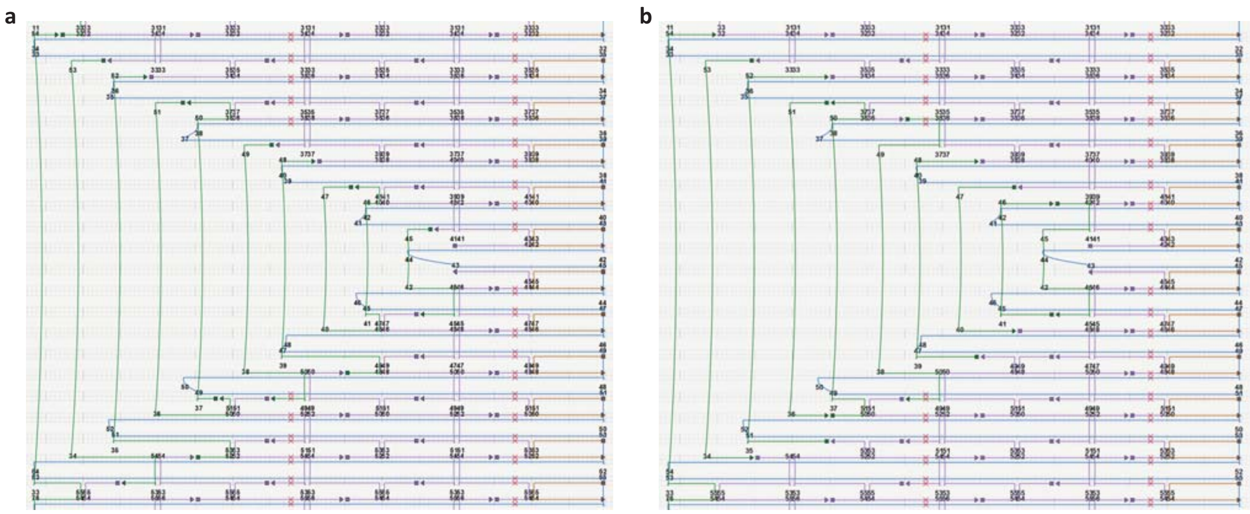

Figure S4: **Two designs of bridge staples for a square DNA origami tile. a,** A "strong-weak" bridge design that uses longer domains on one side of the seams between adjacent triangles and shorter domains on the other. In each of the bridge staples, the stronger side has two domains connected by a staple crossover. Either one of them is longer than 12 nucleotides, or both of them are 7 nucleotides or longer. The weaker side has a single domain of 6 to 8 nucleotides. **b,** A "strong-strong" bridge design that uses sufficiently long domains on both sides of the seams between adjacent triangles.

S2.4 Two types of bridge staples

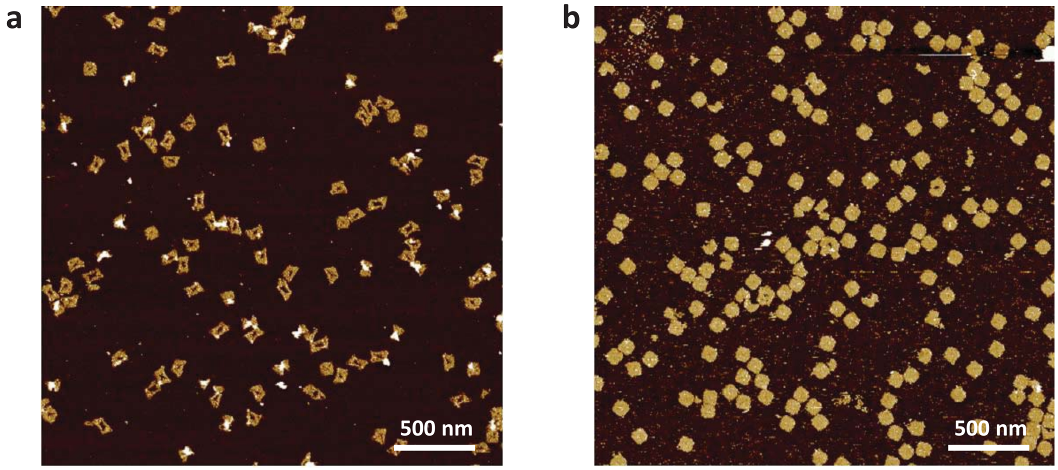

Figure S5: **Square DNA origami tiles with "strong-weak" bridge staples. a,** Tiles with no edge staples. The seams were easily ripped open during AFM imaging. **b,** Tiles with a full set of edge staples each capped with two hairpins. The tiles were more intact compared to those without edge staples.

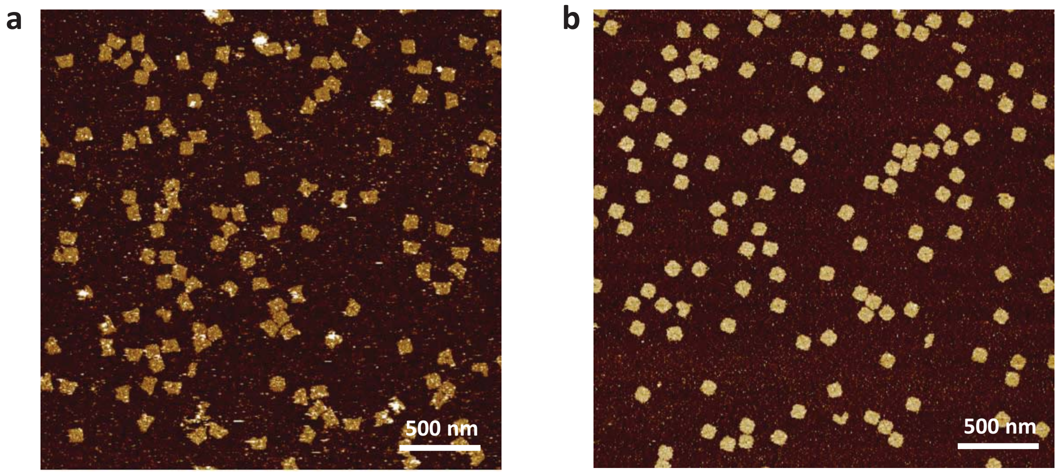

Figure S6: **Square DNA origami tiles with "strong-strong" bridge staples. a,** Tiles with no edge staples. The seams mostly remained closed during AFM imaging. **b,** Tiles with a full set of edge staples each capped with two hairpins. The tiles were fully intact.

S2.5 Three types of edge staples

To verify the formation of square origami tiles as monomers, we modified the edge staples to minimize the interactions between tiles. We explored four options: removing all edge staples (Fig. S6a), using truncated edge staples (Fig. S7), creating coded edges (Fig. S8), and capping the edge staples with hairpins (Fig. S9). The last design worked the best in terms of preserving the integrity of the square shape and effectively reducing the tile-tile interactions. The capping mechanism was also used for creating inert edges near the exterior of finite arrays with designed size, so that the finite arrays were protected from aggregating into larger structures.

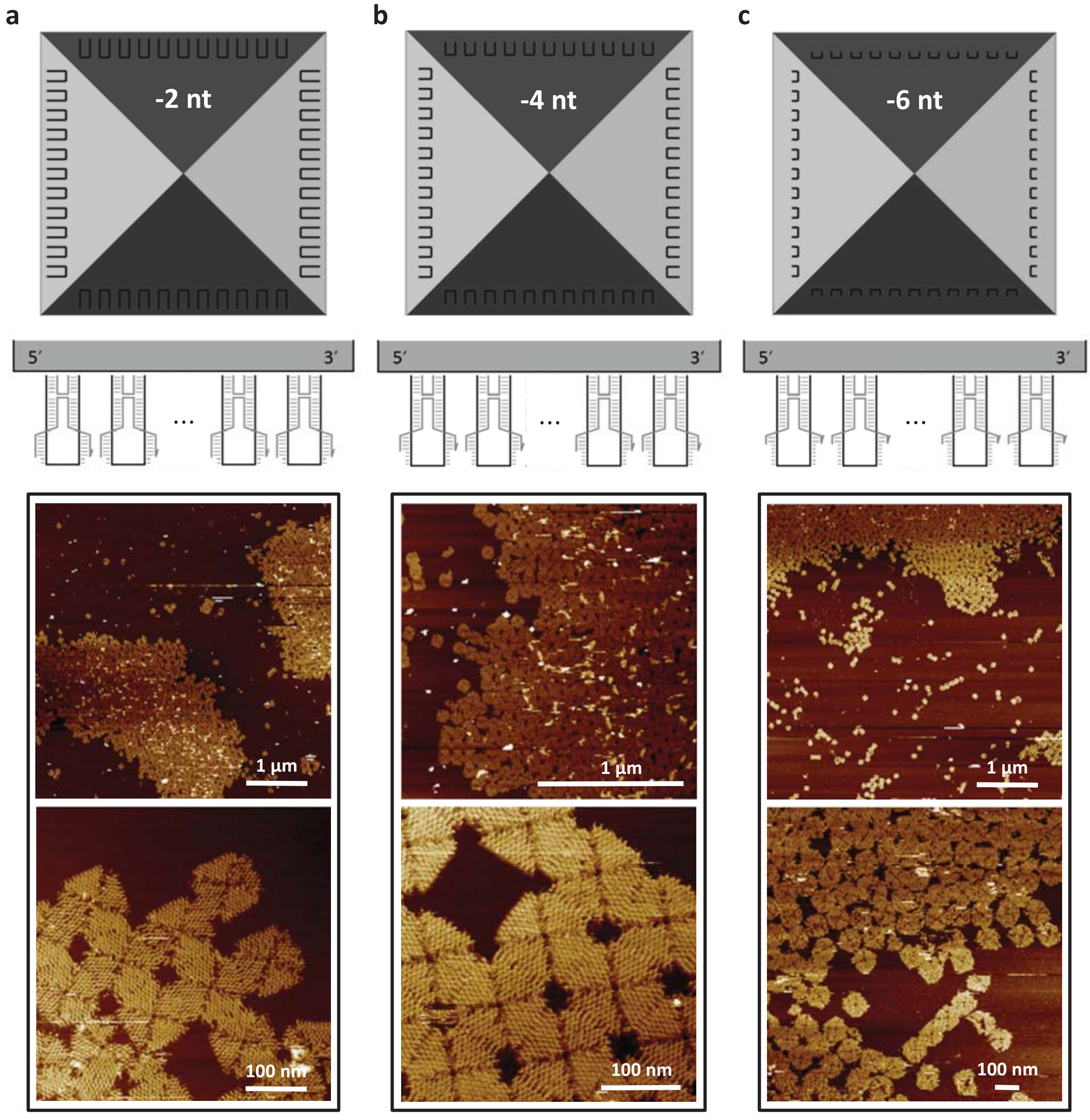

Figure S7: **Square DNA origami tiles with truncated edge staples.** Abstract tile diagrams, edge designs, and AFM images of tiles with **a,** 2-nucleotide, **b,** 4-nucleotide, and **c,** 6-nucleotide truncations at both 3' and 5' ends of each edge staple. Tiles with edge staples truncated in all three lengths were still able to bind to each other and aggregate into larger structures, presumably because the short single-stranded scaffold loops can move out of the way and the remaining blunt ends of double helices were still able to form stacking bonds.

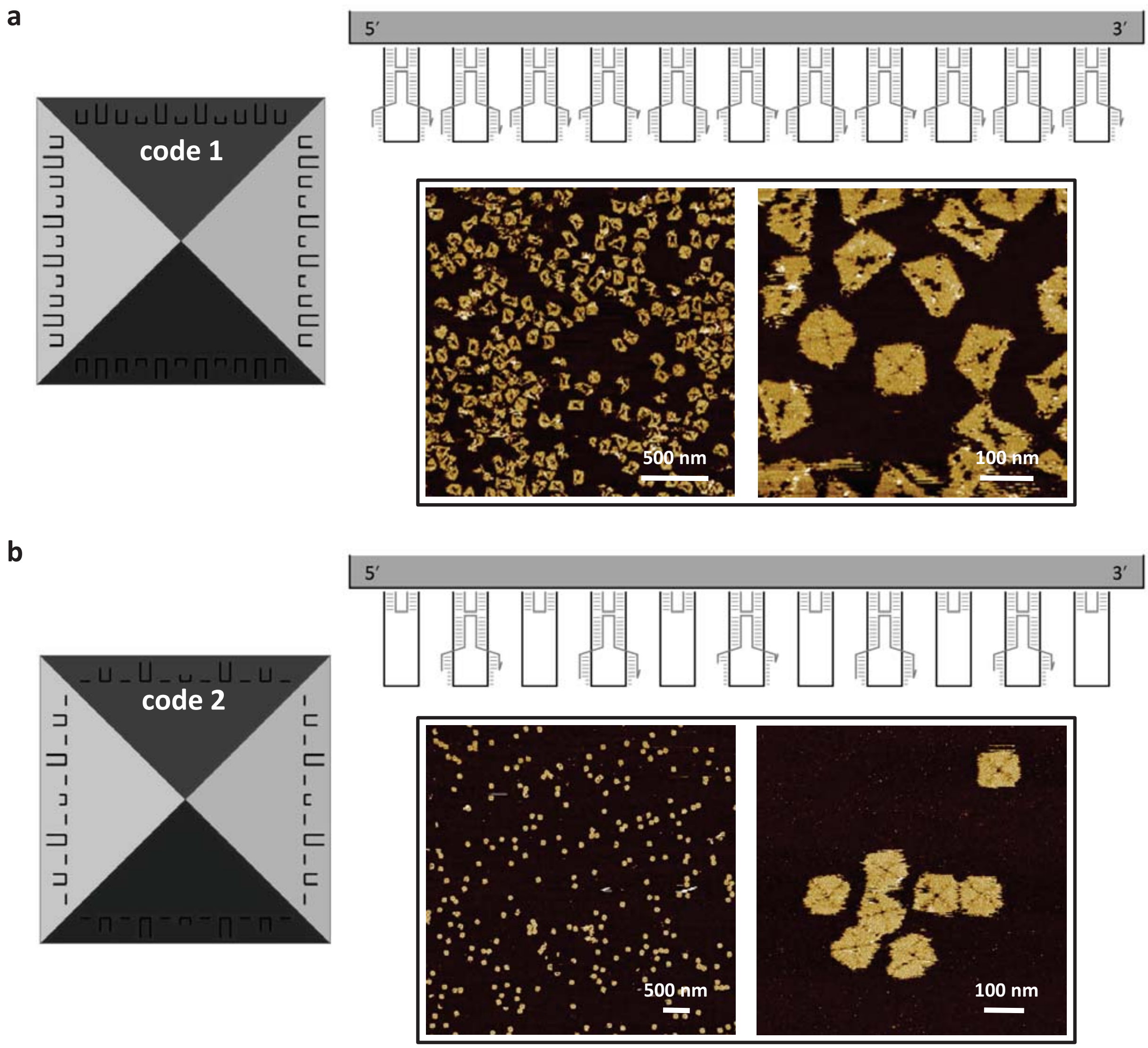

Figure S8: **Square DNA origami tiles with coded edges.** Abstract tile diagrams, edge designs, and AFM images of tiles with **a,** code 1 (42462626424) and **b,** code 2 (_4_2_6_2_4_). Numbers indicate the lengths of nucleotide truncations in the edge staples. Underscores indicate edge staples that were removed. Tiles mostly remained as monomers with both codes. Tiles with code 1 had significant deformation of the square shape, presumably because the short single-stranded scaffold loops near a particular edge had significant spurious interactions with each other and pulled that edge tighter than others. Tiles with code 2 had less deformation, but some monomers were still able to bind to each other and form small groups of 2 to 5 tiles.

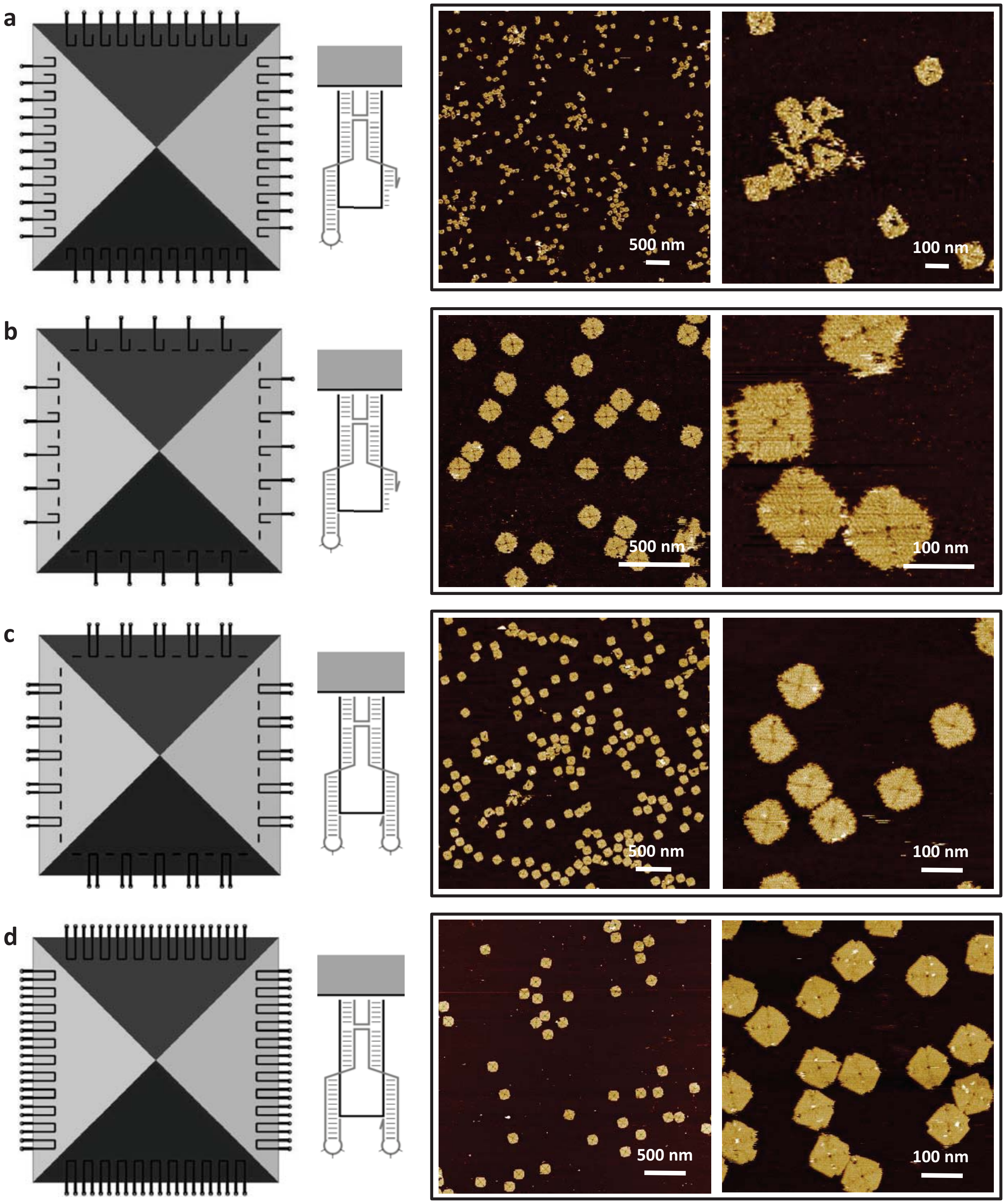

Figure S9: **Square DNA origami tiles with capped edge staples.** Abstract tile diagrams, edge staple designs, and AFM images of tiles with **a,** A full set of edge staples each truncated on the 3' end and capped with a hairpin on the 5' end. **b,** A partial set of edge staples with truncations and hairpins. **c,** A partial set of edge staples each capped with hairpins on both 3' and 5' ends. **d,** A full set of edge staples with hairpins. Tiles with the last design had least deformation and interactions between tiles, and thus was used for all following designs where inert edges were required.

S2.6 High resolution AFM images

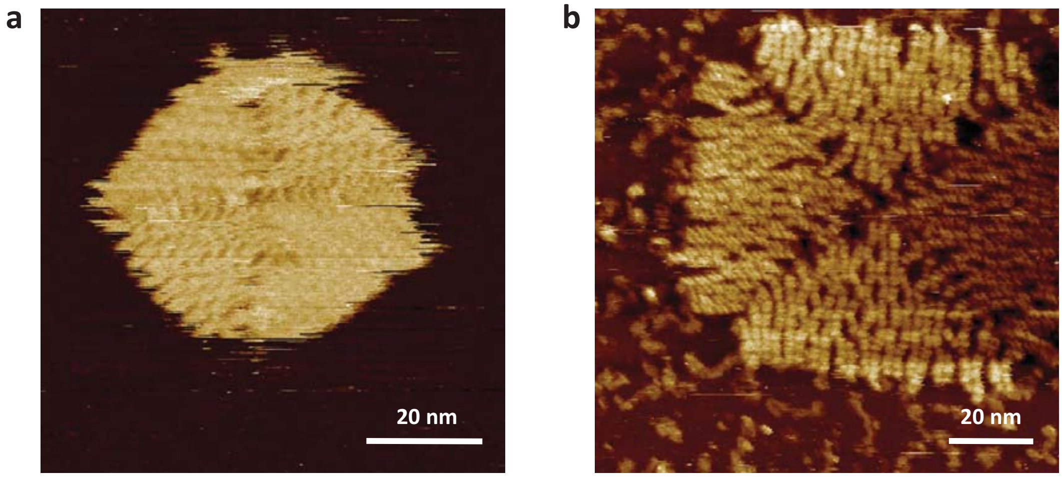

Figure S10: **High resolution AFM images of square DNA origami tiles. a,** A tile under regular imaging condition in 1× TE/Mg^{2+}. **b,** A tile imaged in 1× TE buffer containing 10 mM $MgCl_2$ and 10 mM $NiCl_2$. Nickel reduced the mobility of tiles on mica surface and allowed for resolving of subnanometer features, such as individual helices and their major and minor grooves. Minor and major groove distances measured from this image agreed with X-ray crystallography data in prior publications. Note that nickel is like a strong glue, and the structure is almost certainly distorted by binding to mica, unlike when it is free-floating in solution. Thus we cannot draw conclusions about the features of the more flexible components in the structure (e.g. near the seams and near the edges).

S2.7 Yield calculation

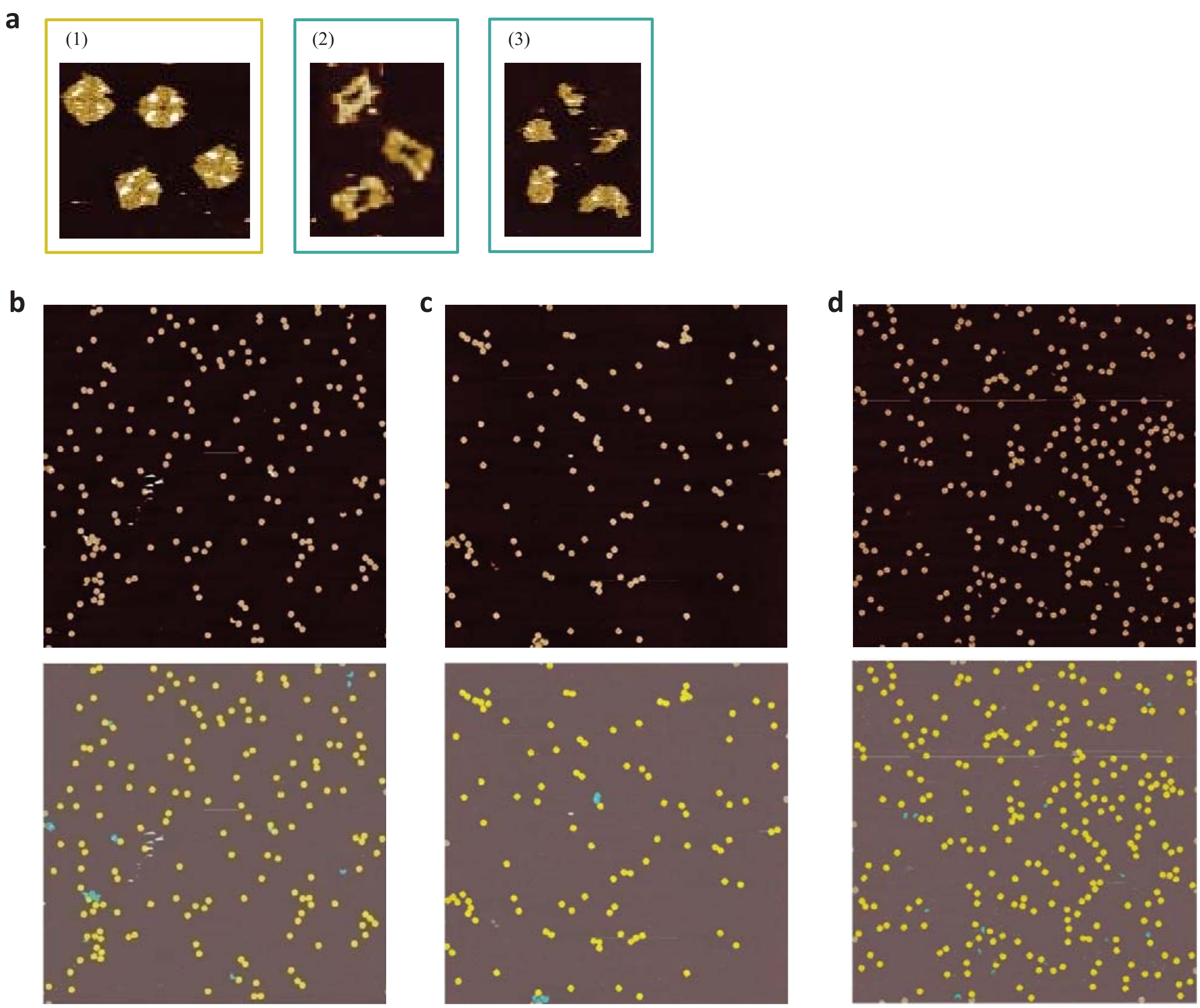

Figure S11: **Calculating the yield of individual origami tiles using different annealing protocols. a,** The tiles are differentiated by their "quality": (1) on target (2) off target (3) malformed. Yellow box around (1) indicates "good quality" structures that were selected; blue boxes around (2) and (3) indicate "bad quality" structures that were not selected. **b,** 7.5× excess of staples annealed from 90 to 20 °C at 1 °C/min: 94.1% yield. **c,** 1.5× excess of staples annealed from 90 to 20 °C at 0.1 °C/min: 95.7% yield. **d,** 7.5× excess of staples and double-stranded extensions in the pattern of two arcs, annealed from 90 to 20 °C at 1 °C/min: 98.0% yield.

S3 Unbounded arrays of square DNA origami tiles

S3.1 Using stacking bonds only

In the simplest case, we constructed origami tiles with all 11 edge staples left unmodified to provide two stacking bonds at the 5' and 3' end of each staple. Arrays on the scale of 500×500 nm were self-assembled (Fig. S12). These arrays showed aggregation near the exterior of the structure and misalignment between tiles, which suggested that the binding energy was too strong and the specificity was not high enough.

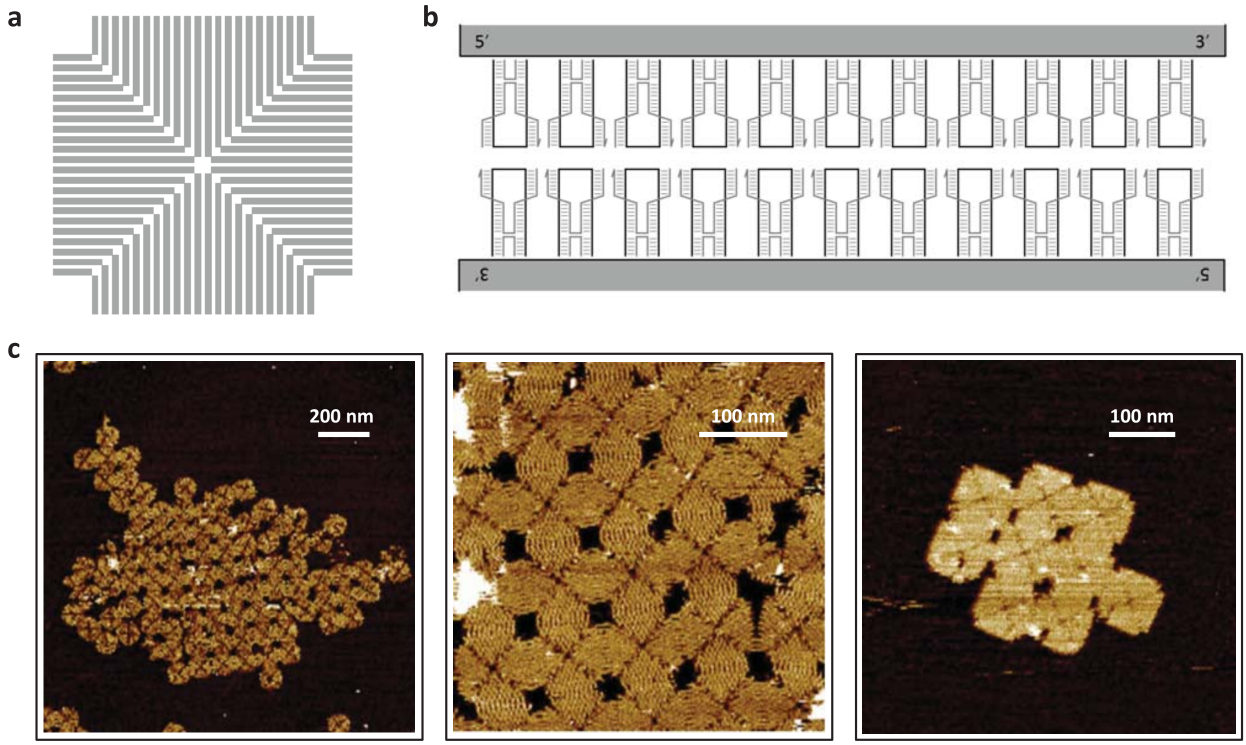

Figure S12: **Unbounded arrays of square DNA origami tiles in which each side has 11 edge staples, each of which have two stacking bonds. a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. The left image is a representative array of approximately 500 × 500 nm, consisting of roughly 50 tiles, with aggregation near the exterior of the structure. The middle image is a zoom-in of the interior structure of a representative array, clearly showing that the neighboring tiles are attached to each other with 11 pairs of bonds. The right image shows an example of misalignment between tiles. It is not surprising that the origami tiles were misaligned, because the sequences of the edge staples were dependent on the M13 scaffold sequence, consisting of stacking bonds with all possible A-T and G-C interactions along the edges of the origami tile. As the weakest stacking bond (a T-A and A-T stack) is approximately 10% of the strongest (a G-C and C-G stack),[8] origami tiles with a mix of various stacking bonds between two edges can be misaligned to maximize the binding energy.[1] Sequences of staple strands are listed in Tables S1 and S4.

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To reduce the binding energy between two edges and increase specificity, we took out 6 edge staples which resulted in a total of 10 stacking bonds when two tiles are perfectly aligned, and a maximum of 6 stacking bonds when they are misaligned. With this tile, arrays of increased sizes on the scale of 1×1 μm and with better alignment were self-assembled (Fig. S13).

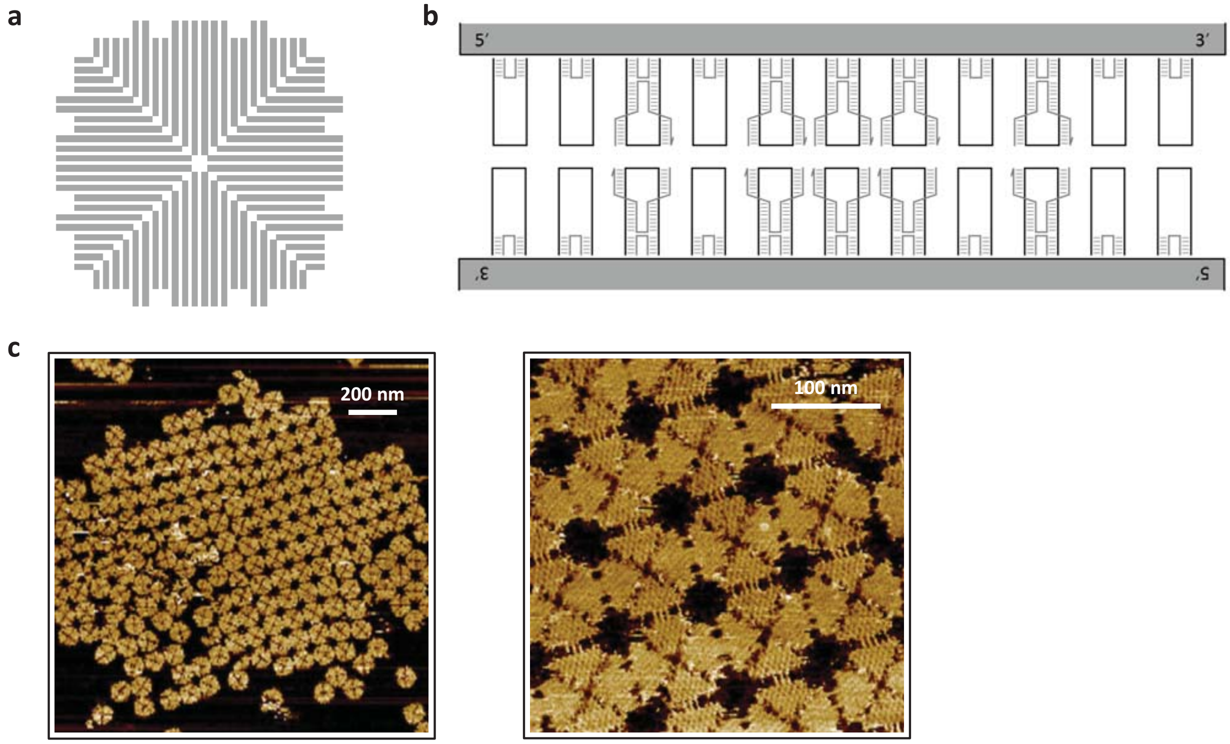
a b c


Figure S13: **Unbounded arrays of square DNA origami tiles in which each side has 5 edge staples, each of which have two stacking bonds.** **a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. The left image is a representative array of approximately 1×1 μm, consisting of roughly 150 tiles, with some aggregation and some clean lines near the exterior of the structure. The right image is a zoom-in of the interior structure of a representative array, clearly showing that the neighboring tiles are attached to each other with 5 pairs of bonds, spaced as shown in (b). Sequences of staple strands are listed in Table S1 and Edg-TiRjC7 ($i = 1, 2, 3, 4$ and $j = 04, 08, 10, 12, 16$) in Table S4.

S3.2 Using stacking bonds and sticky ends

To further increase specificity but maintain a weak binding energy, we constructed an origami tile with 5 edge staples on each side, each having a 1 nt sticky end and a stacking bond. Sticky ends were created with extensions on the 5' end of each staple along two adjacent sides of the square (indicated by blue and orange triangles pointing outward of the tiles in the array abstraction), and truncations on the 3' end of each staple along the other two sides (indicated by blue and orange angles pointing inward of the tiles in the array abstraction). Compared to specificity encoded in geometry alone with the location of stacking bonds, sticky ends provide extra specificity encoded in the sequence of base pairing, which promoted the self-assembly of larger arrays up to 2×2 μm in size (Fig. S14).

Note that unlike the tiles with stacking bonds only (Figs. S12 and S13), tiles with sticky ends now have well-defined relative orientations, because the sticky end sequences of truncated edge staples depend on the M13 scaffold sequence and thus are distinct on each side of the square DNA origami tile (e.g. indicated by distinct colors in Fig. S14ab).

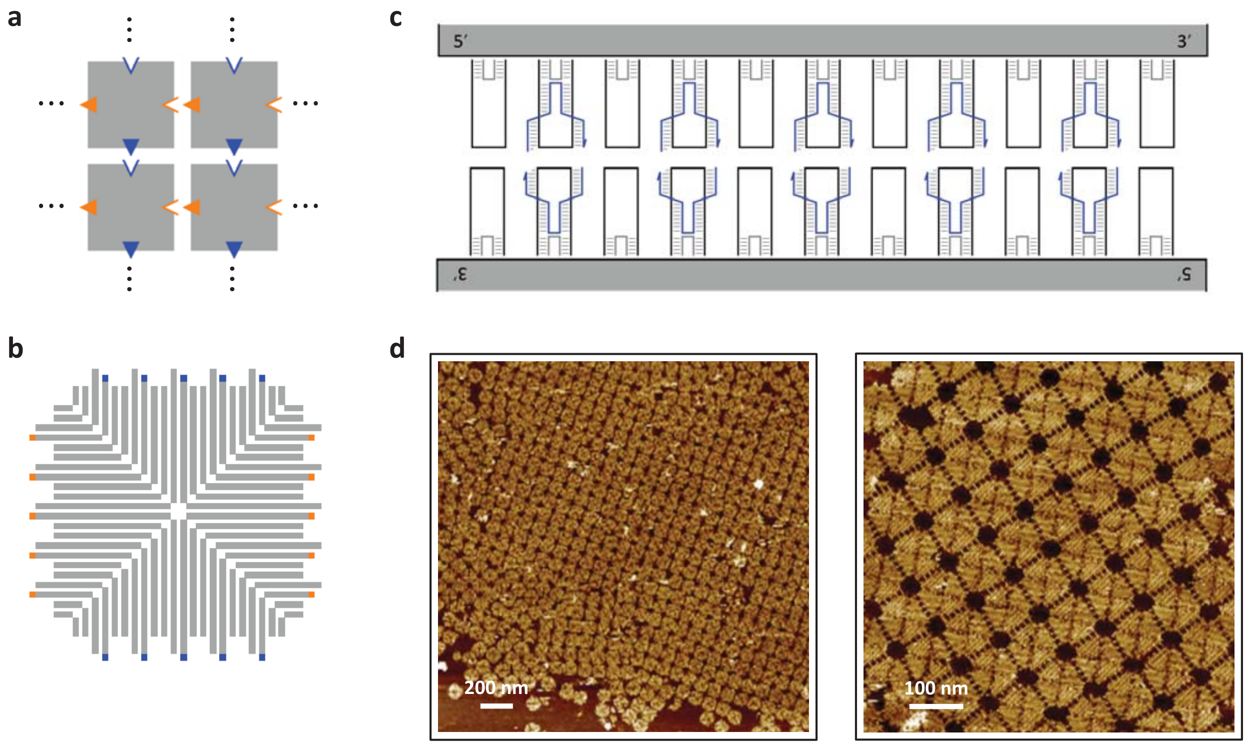


Figure S14: **Unbounded arrays of square DNA origami tiles in which each side has 5 edge staples, each of which have a 1-nucleotide sticky end and a stacking bond. a,** Array abstraction, **b,** Tile abstraction, **c,** Edge design, and **d,** AFM images. The left image is a representative array of approximately 2×2 μm, consisting of roughly 400 tiles. The right image is a zoom-in of the interior structure of a representative array, clearly showing that the neighboring tiles are attached to each other with 5 pairs of bonds, spaced as shown in (c). Sequences of staple strands are listed in Table S2, and Edg-1nt-Rec-T1C7Rj, Edg-1nt-Rec-T2C7Rj, Edg-1nt-G1-T3C7Rj and Edg-1nt-G2-T4C7Rj ($j = 02, 06, 10, 14, 18$) in Table S7.

S3.3 The formation of tubes vs. crystal arrays

Since our goal was to create Truchet patterns on DNA origami arrays, it was important to understand how surface modifications on origami tiles may affect the growth of two-dimensional arrays. In fact, when double-stranded staple extensions were added to the surface of origami tiles, the formation of arrays was discouraged and AFM images showed ribbon-like structures (Fig. S15). This result was an indication that the origami tiles had curvature in the square shape which encouraged the formation of tubes, and the tubes were popped open by the AFM tips during the process of imaging on a mica surface.

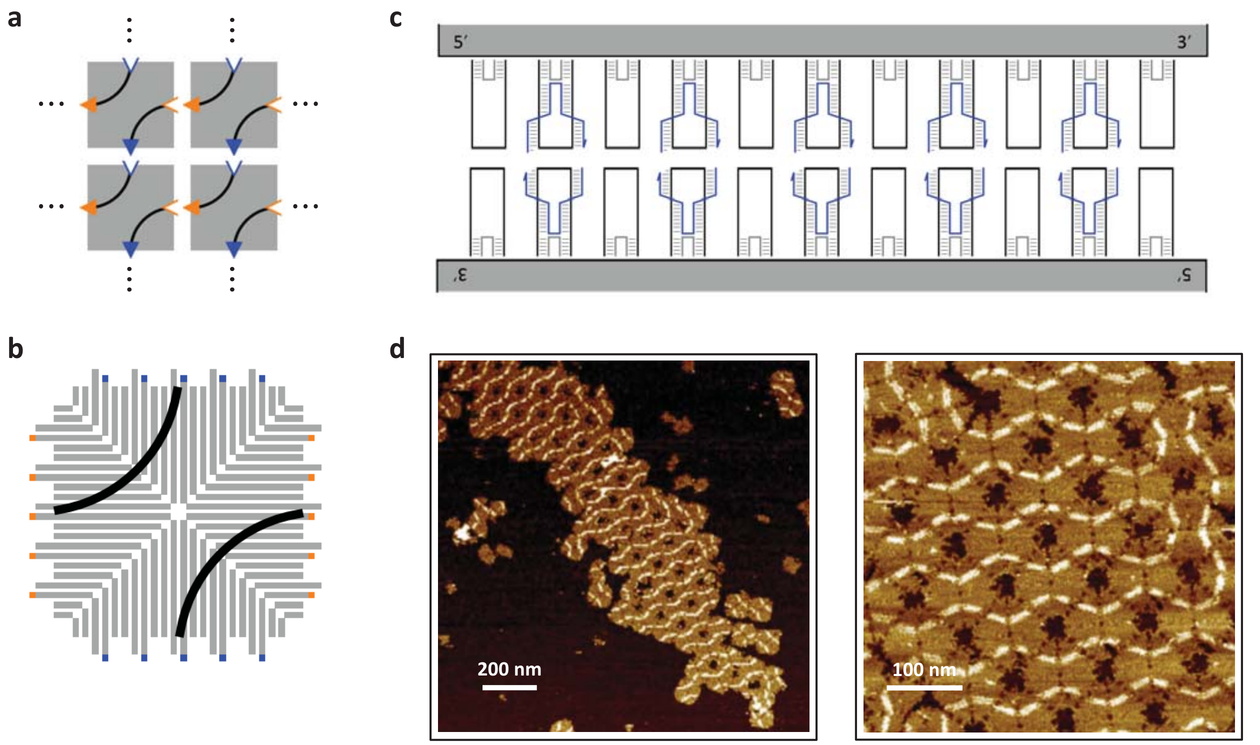


Figure S15: **Unbounded arrays of square DNA origami tiles with double-stranded staple extensions in the pattern of two arcs. a,** Array abstraction, **b,** Tile abstraction, **c,** Edge design, and **d,** AFM images. With the relative tile orientation defined in (a), the array of tiles form a pattern of parallel waves. Sequences of staple strands are listed in Table S2, Edg-1nt-Rec-T1C7Rj, Edg-1nt-Rec-T2C7Rj, Edg-1nt-G1-T3C7Rj and Edg-1nt-G2-T4C7Rj ($j = 02, 06, 10, 14, 18$) in Table S7, and Arc1-TiRjCk (all i, j and k) in Table S40. Each pattern staple Arc1-TiRjCk replaces an interior staple Reg-TiRjCk in Table S2.

We suspect that the formation of tubes depends on both the curvature of tiles and the binding energy between tiles. The curvature contributes to the formation of tubes by bringing two opposite growing edges of an array closer to each other. Stronger binding energy contributes to the formation of tubes by reducing the reversibility of interactions between tiles within the same assembly and making these unimolecular interactions more favorable than the bimolecular interactions of a new tile attaching to an existing assembly, at low concentrations. Stronger binding energy also corresponds to a higher melting temperature of the arrays, at which the tiles are less rigid and thus the tube formation is more favorable.

For example, comparing the tile that did not form tubes in Fig. S14 and the tile that did form tubes in Fig. S15, the only difference is surface modification which presumably introduced curvature to the tile. On the other hand, the tile with no surface modification in Fig. S16 still formed tubes, and the only difference between this tile and the tile in Fig. S14 is more edge staples and thus a stronger binding energy between tiles.

Because the edge design in Fig. S16 is much stronger than that in Fig. S15, the tubes were less easy to open up and become ribbons during AFM imaging, and thus we were able to obtain images with partially opened tubes, confirming the speculation of tube formation.

With the same edge design, the tube without arc pattern (Fig. S16c, left image) was wider than the ones with arc pattern (Fig. S16c, middle and right images), suggesting that the surface modification did increase the curvature of tiles. Note that the edges of the tubes were along the diagonals of the tiles, agreeing with the presumption that the tiles are most flexible along the seams between adjacent triangles connected by single-stranded bridge staples. These two phenomena were consistent in other AFM images not shown here.

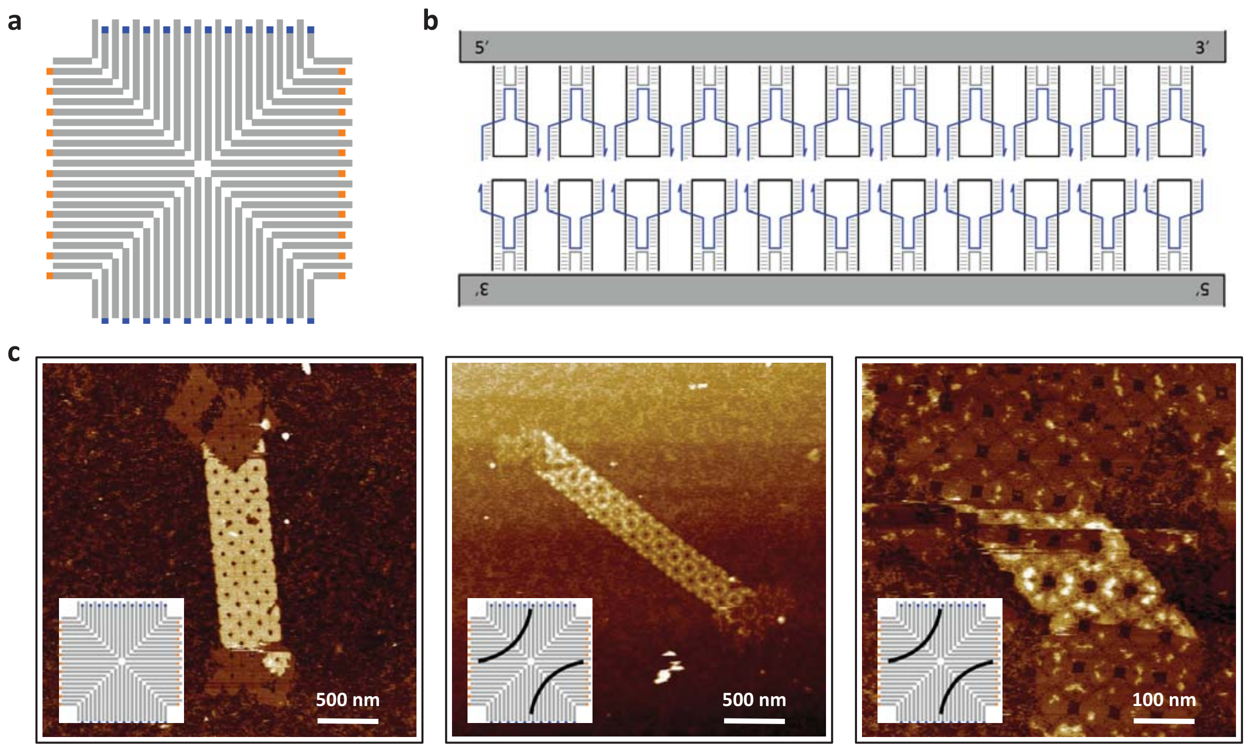


Figure S16: **Unbounded arrays of square DNA origami tiles that form partially opened tubes. a,** Tile abstraction. Giving and receiving edges are on the opposite sides, and the tiles attach to each other with the same orientation. **b,** Edge design. Each side of the tile has 11 edge staples, each of which have a stacking bond and a 1-nucleotide sticky end. **c,** AFM images. The left image shows a tube of tiles with no surface modification, partially opened near the two ends. The middle image shows a partially opened tube of tiles with a pattern of two arcs. The right image shows a mostly opened tube of tiles with a pattern of two arcs. Sequences of staple strands are listed in Table S2, Edg-1nt-Rec-T1C7Rj, Edg-1nt-Rec-T2C7Rj, Edg-1nt-G1-T3C7Rj and Edg-1nt-G2-T4C7Rj (all j) in Table S7, and Arc1-TiRjCk (all i, j and k) in Table S40. For tiles with patterns, each pattern staple Arc1-TiRjCk replaces an interior staple Reg-TiRjCk in Table S2.

Using a partial arc pattern to create a difference between the two orientations of the tiles that face up and down in an image, we confirmed that the double-stranded staple extensions were on the outside of the tubes (Fig. S17). Because of this observation, we hypothesized that the curvature was caused by the double-stranded staple extensions repelling each other on the surface of the origami tile.

Compared to Fig. S15, we used a different edge design in Fig. S17 to simultaneously explore if longer sticky ends with increased specificity would result in better array formation. To maintain weak binding energy between tiles, we reduced the number of edge staples while increasing the length of sticky ends. However, the experimental results suggested that without addressing the curvature introduced by surface modification, increasing specificity alone was not necessarily helpful.

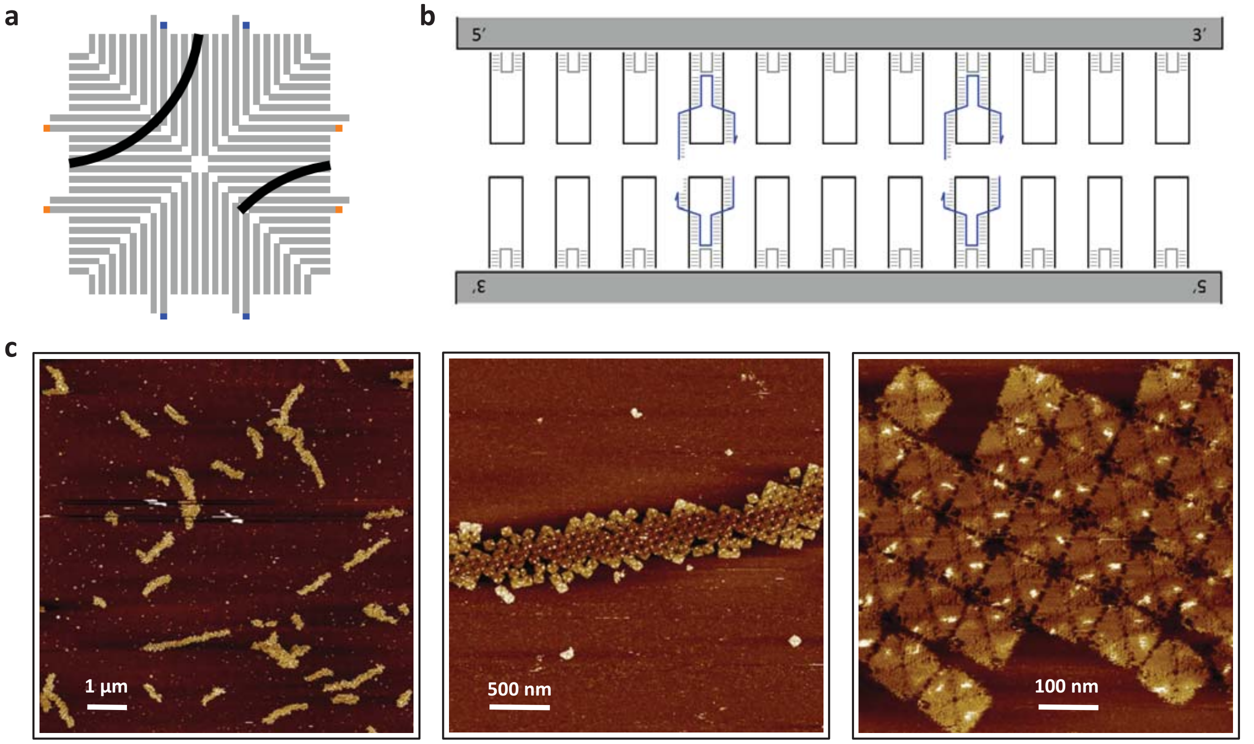


Figure S17: **Unbounded arrays of square DNA origami tiles showing surface modification on the outside of the opened tubes. a,** Tile abstraction. Giving and receiving edges are on the opposite sides, and the tiles attach to each other with the same orientation. The tile is labeled with a pattern of one and a half arcs, creating a difference between the two orientations of the pattern that face up and down. **b,** Edge design. Each side of the tile has 2 edge staples, each of which have a stacking bond and a 4-nucleotide sticky end. **c,** AFM images showing that the pattern was facing down, and thus the surface modification was on the outside of the tubes. Sequences of staple strands are listed in Tables S2 and S9, and Arc1-TiRjCk ($i = 1, 2$ and 4, all j and k) in Table S40. Each pattern staple Arc1-TiRjCk replaces an interior staple Reg-TiRjCk in Table S2.

To reduce the curvature and promote robust array formation of origami tiles with surface modifications, we used a global self-correction mechanism that allows individual tiles to have curvature but prevents the accumulation of this curvature during self-assembly. Unlike the designs shown in Figs. S14 to S17, in which all tiles attach to each other with the same orientation, the alternative edge design (Fig. S18) forces the tiles to attach to each other with a 90° rotation. Similar to the "corrugated" design introduced in self-assembled arrays of cross-shaped small DNA tiles[9,10] and origami tiles,[11] our design allows the curvature of a single tile to be somewhat balanced within its 2 by 2 tile neighborhood in an array. Unlike the "corrugated" design in origami tiles, our self-correction mechanism does not require a flipped orientation of tiles and thus allows surface modifications on one side of a tile to continue into neighboring tiles.

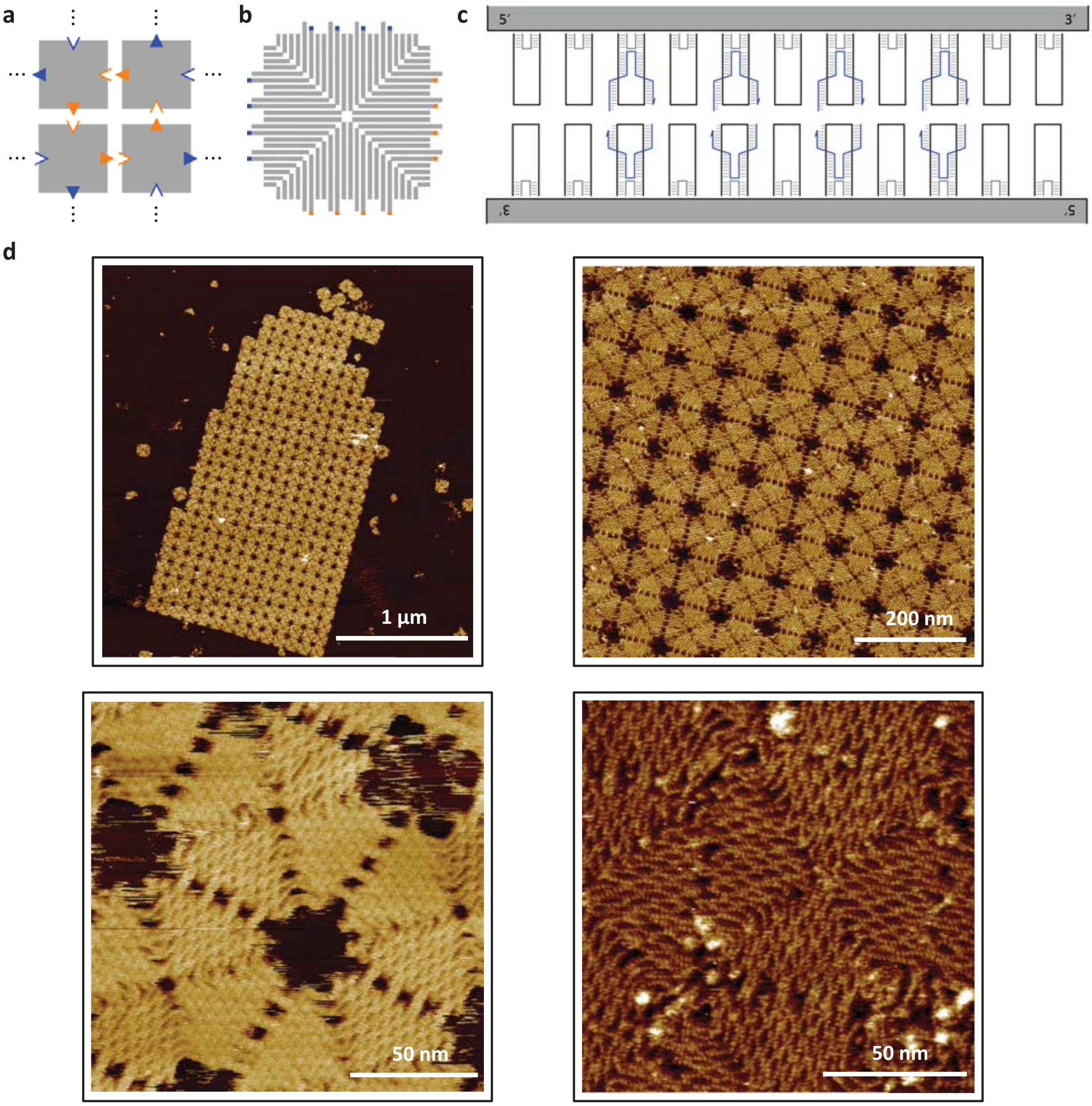


Figure S18: **Unbounded arrays of square DNA origami tiles. a,** Array abstraction, **b,** Tile abstraction, **c,** Edge design, and **d,** AFM images. The bottom right high-resolution image was obtained in 1× TE buffer containing 10 mM $MgCl_2$ and 10 mM $NiCl_2$, and other images were obtained in 1× TE/Mg^{2+}. Sequences of staple strands are listed in Tables S2 and S11.

With the global curvature correction mechanism, even with surface modifications, the self-assembly of large arrays became possible (Fig. S19). Compared to the edge design in Figs. S14 and S15, the edge design in Figs. S18 and S19 uses slightly longer sticky ends and fewer edge staples, but with a similar binding energy. The increase in specificity also helped the formation of crystalline arrays. For example, comparing the left AFM image in Fig. S14d and the top left image in Figs. S18d and S19d, the arrays in latter images had more uniformly-oriented domains and straight edges. The straight edges demonstrated the key feature of a crystal: naturally-occurring facets, as in a diamond. With annealing time varying from two days to a week, arrays up to 10 by 10 microns consisting of several thousands of tiles were created (Figs. S20 and S21).

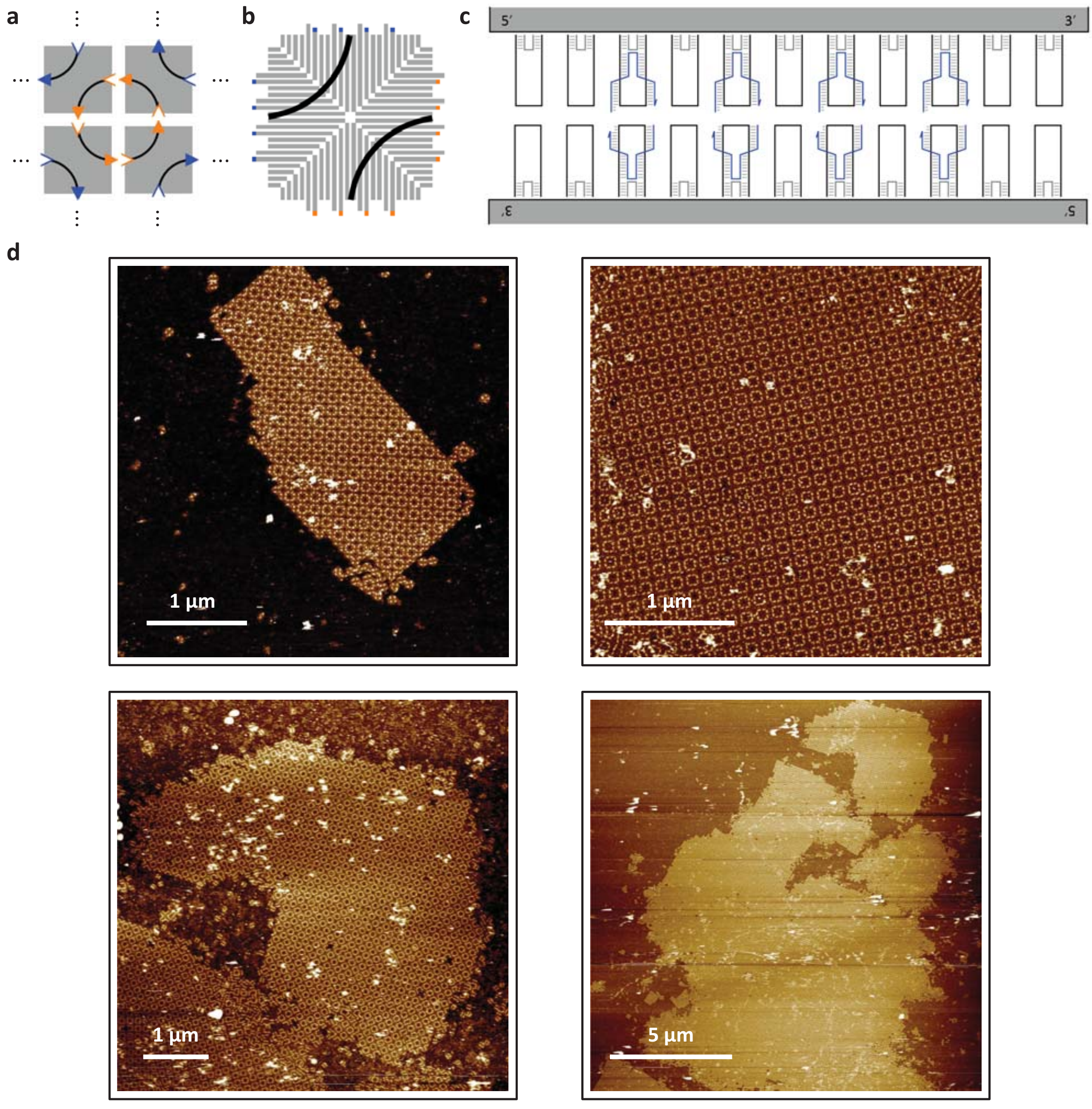


Figure S19: **Unbounded arrays of square DNA origami tiles with double-stranded surface modification that form a pattern of circles. a,** Array abstraction, **b,** Tile abstraction, **c,** Edge design, and **d,** AFM images. Sequences of staple strands are listed in Tables S2 and S11, and Arc1-TiRjCk (all i, j and k) in Table S40. Each pattern staple Arc1-TiRjCk replaces an interior staple Reg-TiRjCk in Table S2.

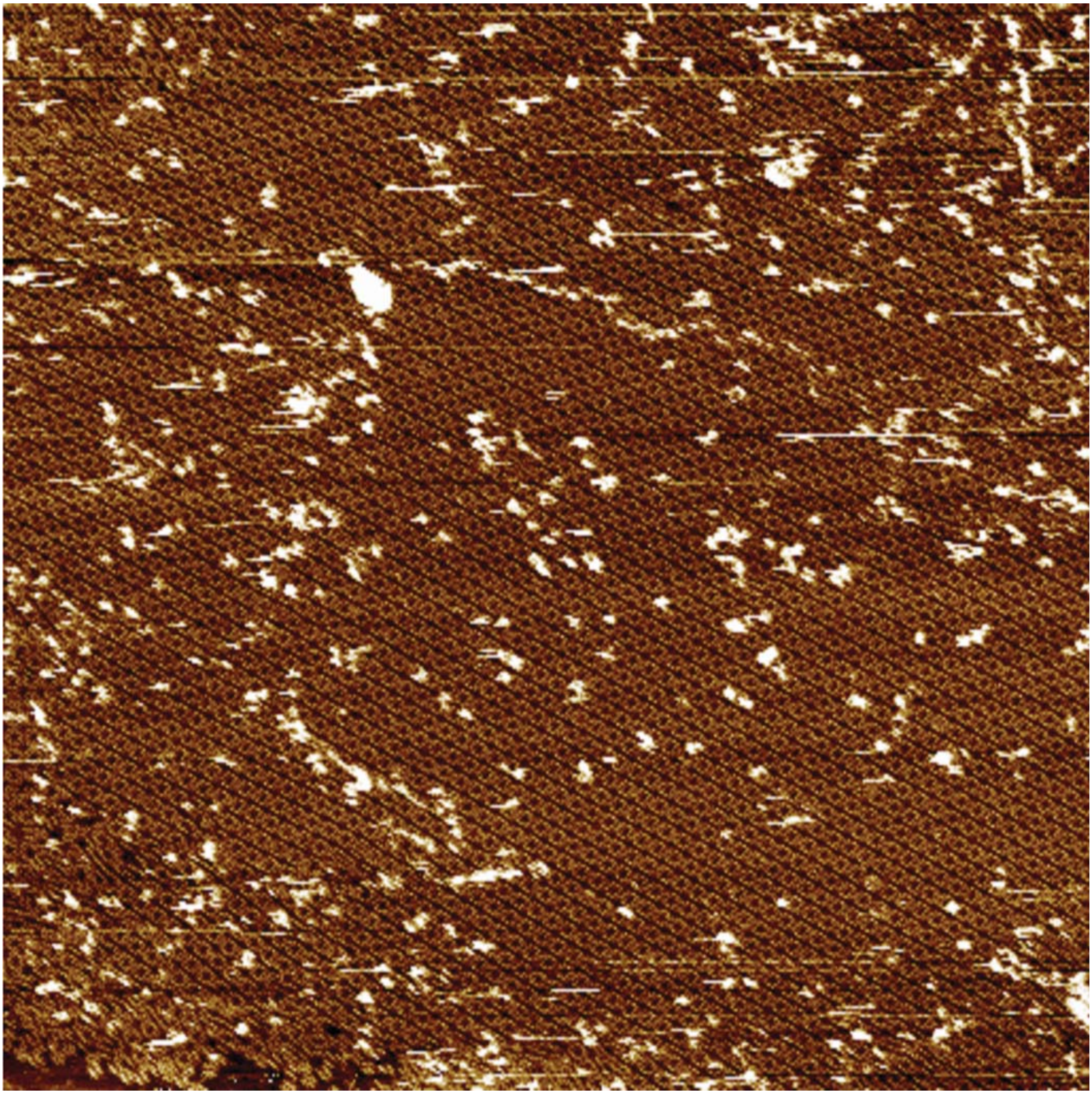


Figure S20: **A 7 by 7 μm AFM image that shows part of a single crystalline domain of unbounded arrays of square DNA origami tiles with double-stranded surface modification that form a pattern of circles.**

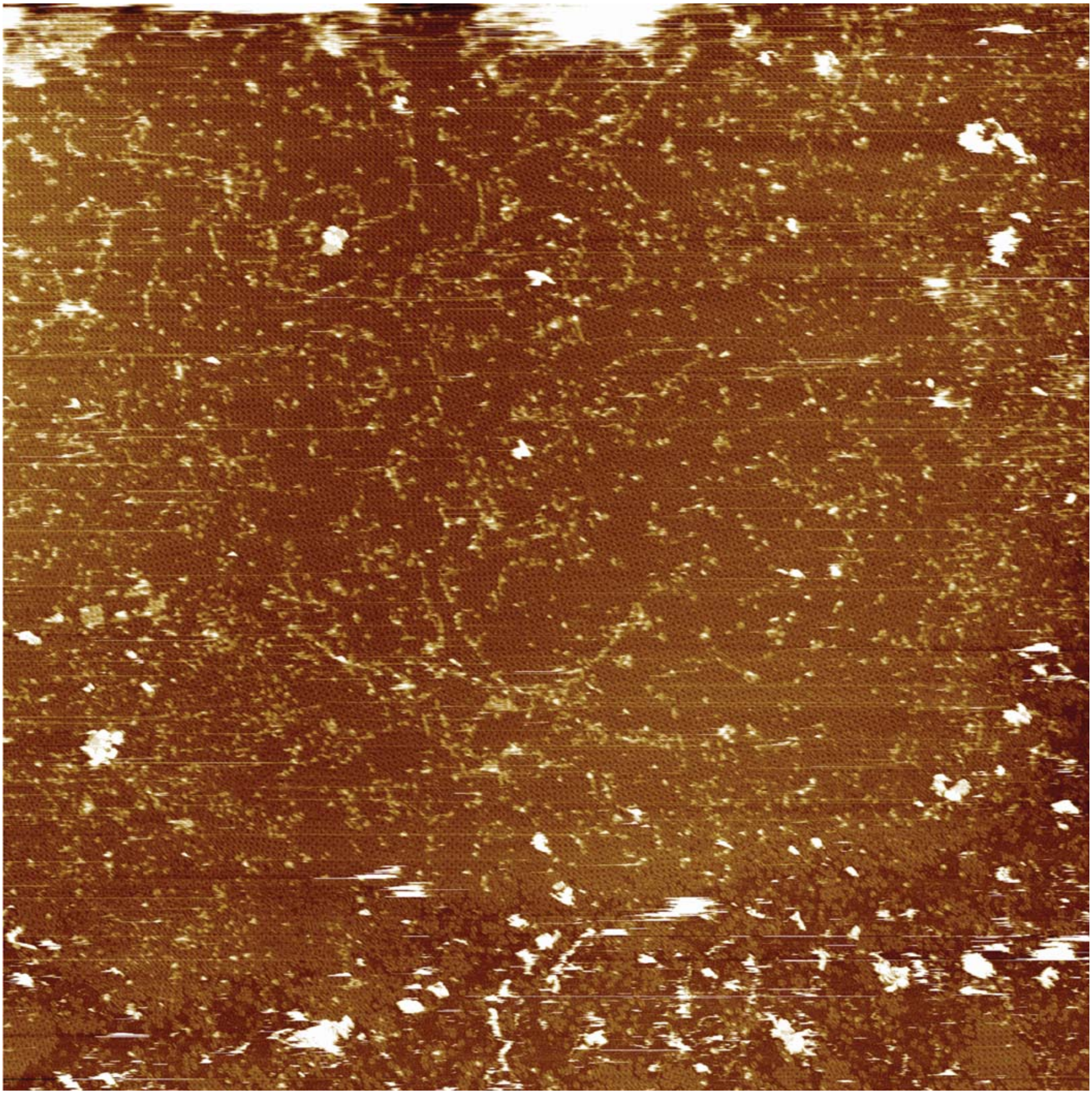


Figure S21: **A 16.2 by 16.2 μm AFM image that shows part of a single crystal of unbounded arrays of square DNA origami tiles with double-stranded surface modification that form pattern a of circles.** At this scale, the crystal had some defects and differently-oriented domains.

With surface modifications, tiles with stacking bonds only are still capable of attaching to each other with all possible orientations. But the AFM images showed tubes with wave patterns instead of arrays with random Truchet patterns (Fig. S22), indicating that the tiles preferred to bind to each other by opposite sides. We suspect that the opposite-side binding was thermodynamically more favorable due to the sequence variation of stacking bonds on four sides of the tile.

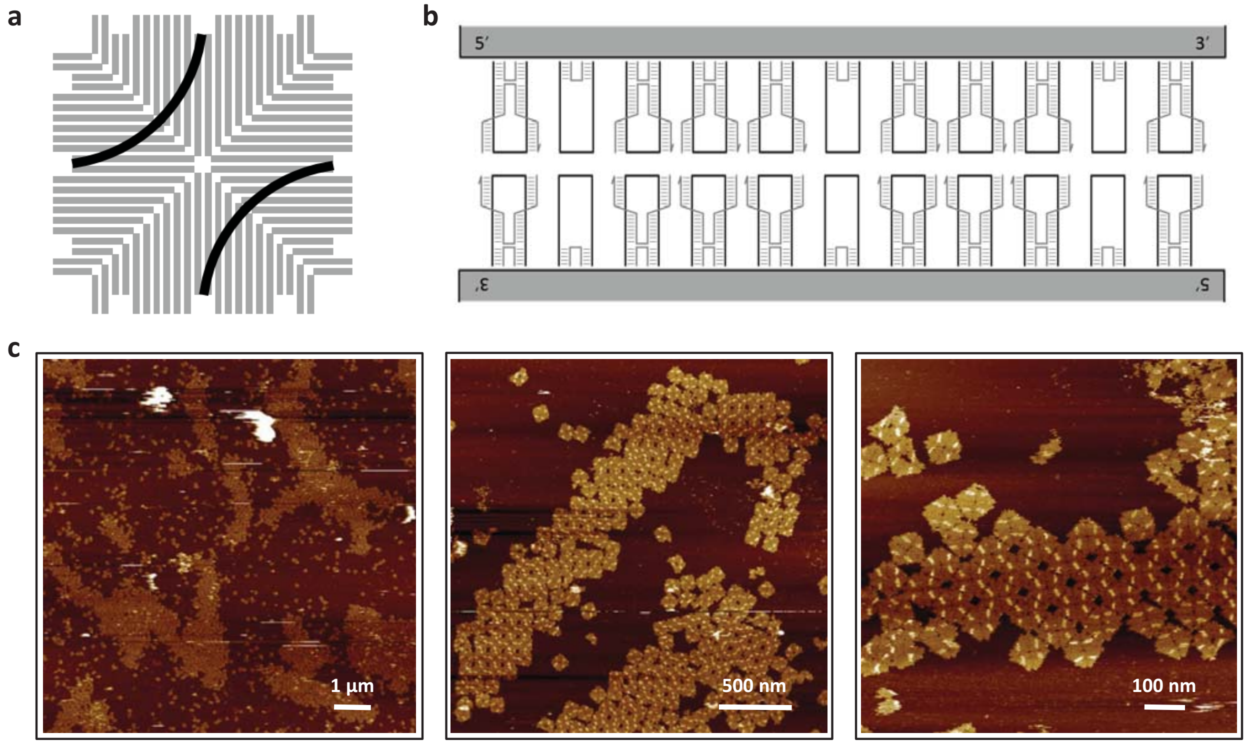


Figure S22: **Unbounded arrays of square DNA origami tiles that form tubes with stacking bonds only.** **a,** Tile abstraction. The tile is labeled with a pattern of two arcs. **b,** Edge design. Each side of the tile has 8 edge staples, each of which have two stacking bonds. **c,** AFM images. Sequences of staple strands are listed in Table S2 and Edg-TiRjC7 ($i = 1, 2, 3, 4$ and $j = 00, 04, 06, 08, 12, 14, 16, 20$) in Table S4.

S3.4 Melting temperature measurement

It is possible to experimentally search for the melting temperature of two-dimensional origami arrays with any particular edge design, and incubate the origami tiles at such a temperature for a long time to obtain ideal crystal growth. However, a stronger binding energy between origami tiles would correspond to a higher melting temperature, at which the origami monomer itself could become structurally unstable. Thus we believe it is desirable to use an edge design with a low binding energy such that the melting temperature of origami arrays is significantly lower than that of the origami tile itself, which is commonly between 55 and 65 °C for DNA origami folded using staples of 20 to 60 nucleotides.[12]

For example, the origami arrays shown in Figs. S18 to S21 had a melting temperature close to 35 °C, measured using both fluorescence experiments (Fig. S23) and AFM experiments (Fig. S24).

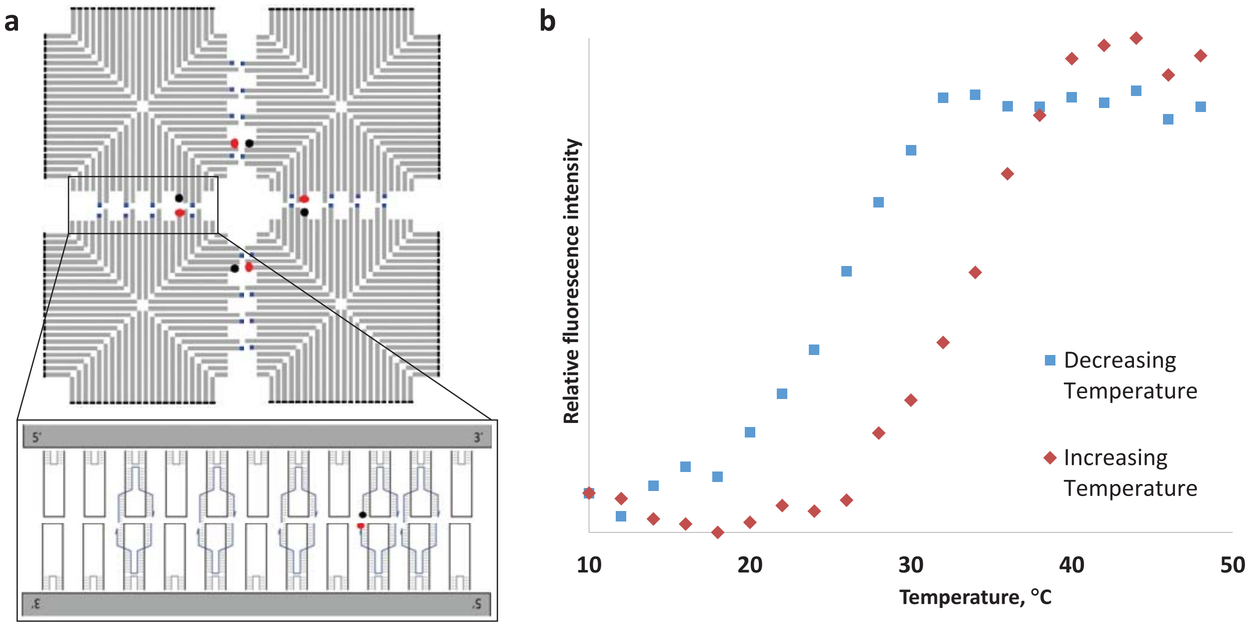


Figure S23: **Fluorescence experiments for melting temperature measurement. a,** Tile abstraction and edge design of a 2 by 2 array. A ROX fluorophore (shown as a red dot) is attached to the 3' end of an edge staple, and a RQ quencher (shown as a black dot) is attached to the 5' end of another edge staple in the same square DNA origami tile. When the tiles self-assemble into 2 by 2 arrays, the fluorophore and quencher will come into proximity and result in low fluorescence intensity. When the arrays melt, the fluorophore and quencher will become separated and result in increased fluorescence intensity. **b,** Melting graph showing relative fluorescence intensity during heating and cooling of the 2 by 2 arrays. The fluorescence intensity was measured on a Fluorolog-3 spectrofluorometer with temperature control (Horiba Scientific). 500 μL of 50 nM origami tiles in a quartz cuvette were heated up and then cooled down with 2 °C increments, allowing 5 minutes for temperature equilibration before each measurement. Fluorescence intensity was measured with 584 nm excitation wavelength and 602 nm emission wavelength. Each data point shown in the graph was an average of three data points taken over three heating and cooling cycles. Note that compared to the edge design shown in Figs. S18 and S19, we moved an edge staple two helices away from its original location, and added an edge staple with fluorophore or quencher on each of the two edges. The fluorophore/quencher staples introduced an additional stacking bond to the interaction between tiles, with which we expect a slightly increased melting temperature. Sequences of staple strands are listed in Tables S2 and S10.

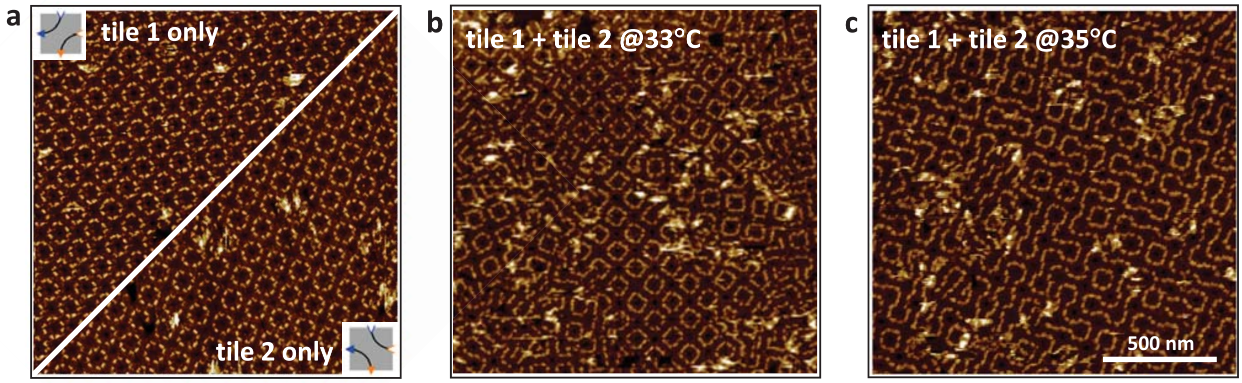


Figure S24: **AFM experiments for melting temperature measurement.** The square DNA origami tile shown in Fig. S19 with two types of surface modifications was used to determine the melting temperature of unbounded arrays. **a,** Arrays of tile 1 and tile 2 both formed patterns of circles when annealed separately. **b,** Patterns of circles mostly remained when arrays of tile 1 and tile 2 were mixed together and incubated at a temperature lower than the melting point for 8 hours, and then cooled down to 20 °C at 0.05 °C/min. **c,** Random Truchet patterns emerged when arrays of tile 1 and tile 2 were incubated at a temperature higher than the melting point. A set of 5 temperatures were tested, including 30, 33, 35, 37 and 40 °C. The AFM images of samples incubated at 30 °C were similar to 33 °C shown in (b), and 37 and 40 °C were similar to 35 °C shown in (c). The scale bar in (c) also applies to (a) and (b). Sequences of staple strands are listed in Tables S2, S11 and S40. Each pattern staple Arc1-TiRjCk or Arc2-TiRjCk in Table S40 replaces an interior staple Reg-TiRjCk in Table S2.

S3.5 Crystal array size dependence on the annealing time

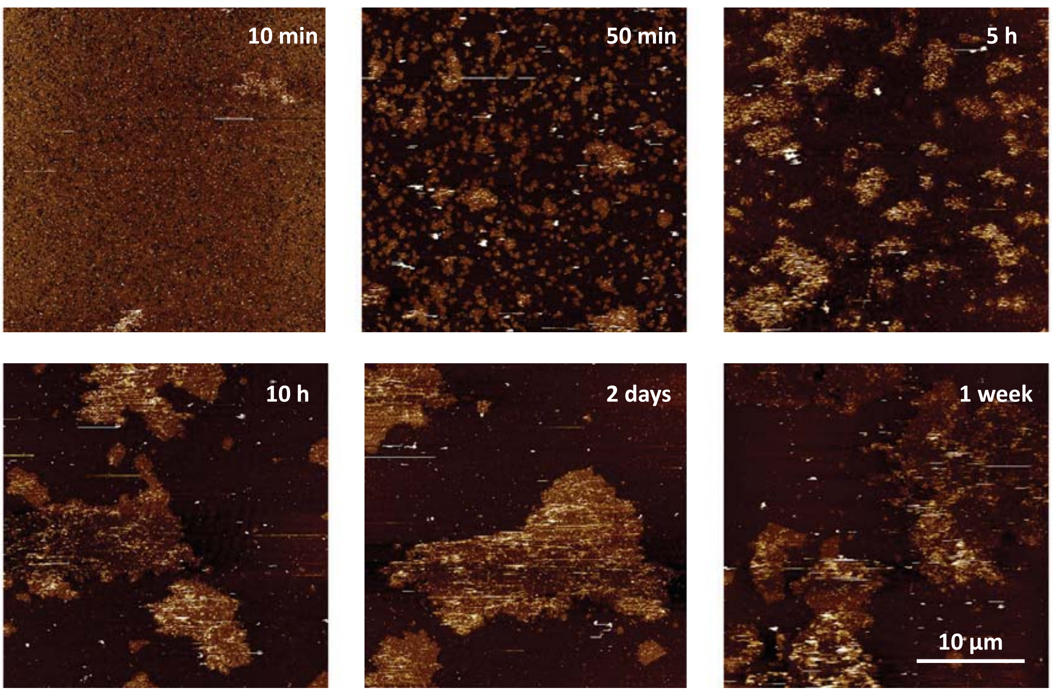


Figure S25: **Representative AFM images of unbounded arrays with increasing annealing time.**

S4 Random loop patterns on unbounded DNA origami arrays

S4.1 Pattern staple design

Custom Mathematica code was developed to read a csv file exported from a Cadnano design and plot the locations of 3' or 5' ends of all staples in the same colors as the Cadnano diagram, from the top view and side view of the square tile (Fig. S26). We avoided using edge staples and bridge staples in pattern designs to eliminate the possibility that surface modifications could interfere with tile-tile interactions and the formation of bridges. But in principle edge and bridge staples could be used to better approximate a pattern.

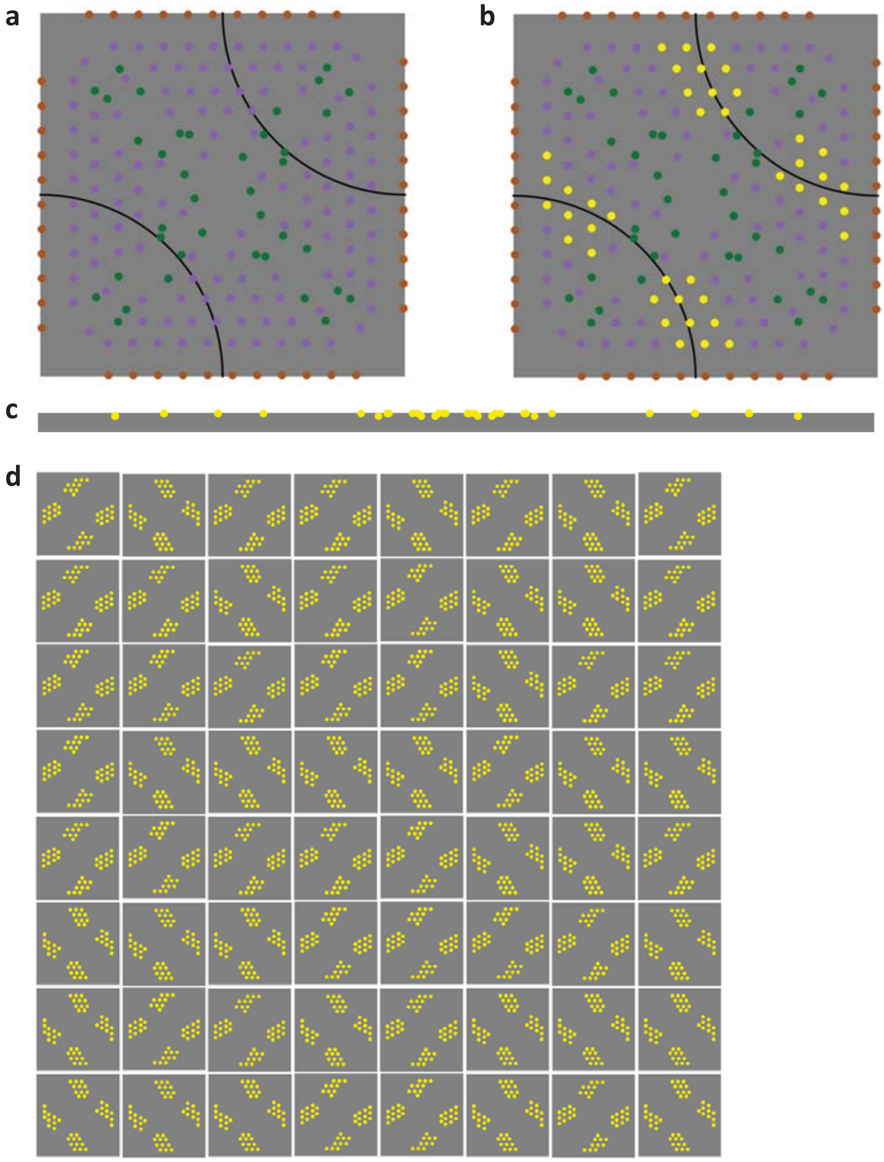


Figure S26: **Select staple extension locations for creating a pattern. a,** Top view of a square origami design, showing 3' end locations of all staples overlayed with an arc pattern. Locations of edge staples are in brown, interior staples in purple, and bridge staples in green. **b,** Top view of the square origami design with staples selected to approximate the arc pattern. Selected staples are in yellow. **c,** Side view of the square origami design, showing 3' end locations of the selected staples. It confirms that all selected locations are close to the same surface of the square tile. **d,** Top view of an array of the square tiles with selected staples, with a random orientation of the tile at each location in the array.

S4.2 Four types of surface modifications

We explored four types of surface modifications including double-stranded, hairpin, dumbbell, and bridge-style extensions. All of them were able to create sufficient contrast in AFM images, with variation in the resolution of patterns (Fig. S27). We chose to use double-stranded staple extensions for all later experiments.

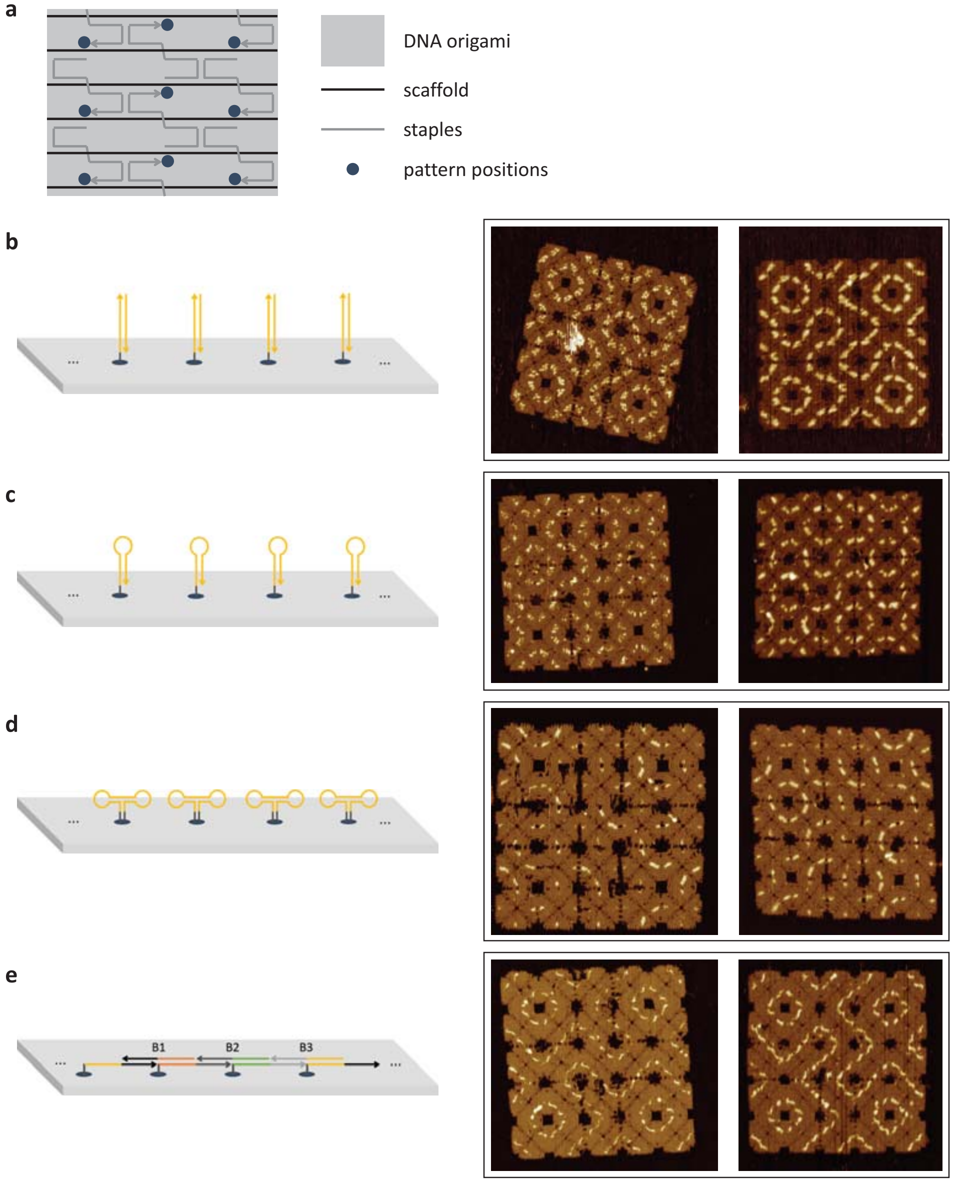


Figure S27: **Four designs of staple extensions for creating patterns and AFM images of fully connected 5 by 5 arrays with the four types of surface modifications. a,** Positions of staple extensions used in (b), (c) and (e). **b,** Double-stranded extensions at the 3' end of selected staples. A strand of 20 As is hybridized to the staple extensions of 20 Ts. The lines in AFM images are 3-pixel wide (a pixel refers to the 5' or 3' end of each staple). **c,** Hairpin extensions at the 3' end of selected staples. The lines in AFM images are 2-pixel wide. **d,** Dumbbell hairpins inserted into the midpoint of selected staples.[3] The lines in AFM images are 2-pixel wide. **e,** Bridge-style extensions at the 3' end of selected staples. Three binder strands of distinct 20-nucleotide sequences are each hybridized to two adjacent staple extensions. Two Ts are inserted as spacers between the 3' end of the selected staples and bridge-style extensions. The lines in AFM images are 1-pixel wide. Left AFM images in (b) to (e) show an example array with surface modifications facing up. Right AFM images in (b) to (e) show an example array with surface modifications facing down. Sequences of staple strands are listed in Tables S2, S19 to S25, S40, and S42 to S44.

S4.3 AFM image coloring

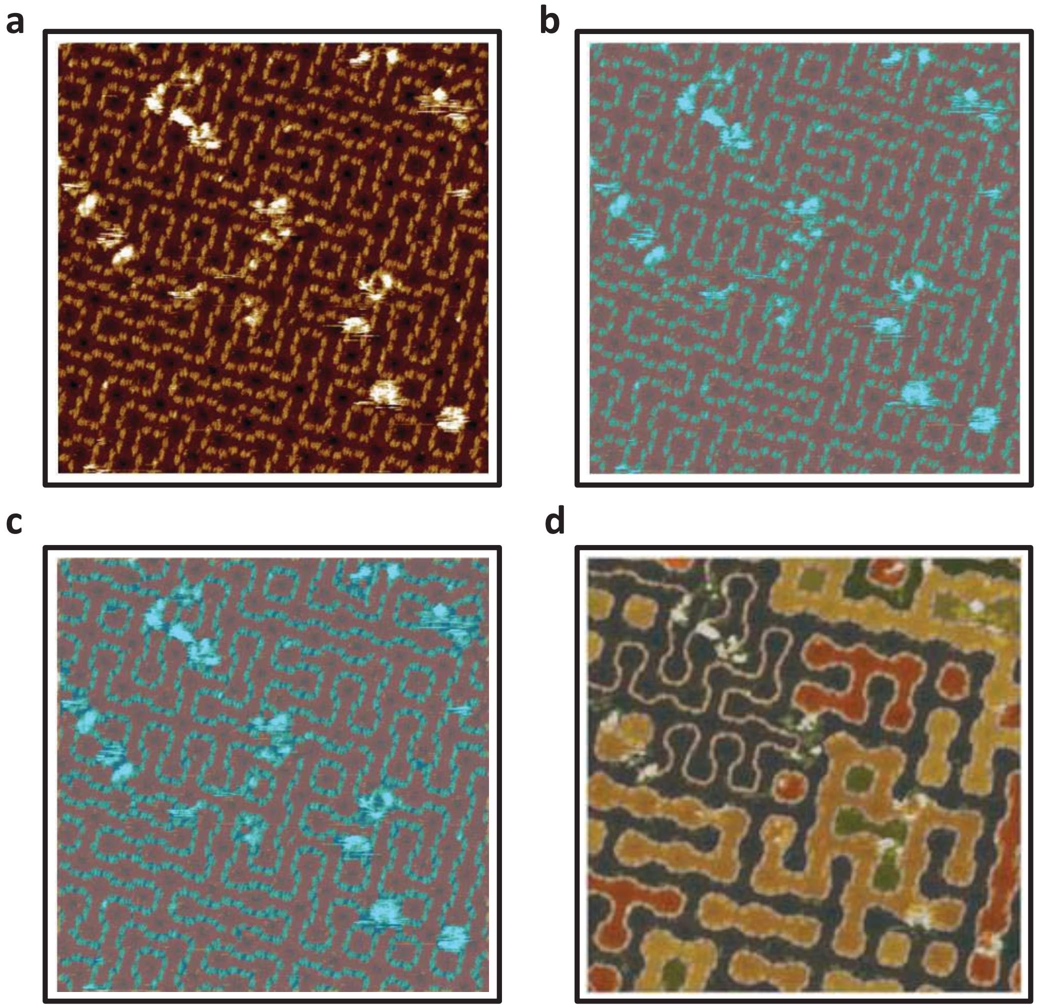


Figure S28: **Coloring the continuous paths of maze-like patterns in AFM images. a,** An example AFM image of square DNA origami arrays with maze-like patterns. **b,** A threshold is applied to the AFM image, and maze walls and detail-obscuring debris are colored as blue. **c,** Nearby walls are connected to each other by digitally expanding the highlighted area followed by erosion. **d,** Finally, orthogonal colors are applied to each segmented maze for easy visualization of the continuous paths in each maze. Corrections to ambiguous wall connections are manually applied. Wall connections under debris is approximated or removed entirely.

S4.4 Unbounded arrays of arc tiles

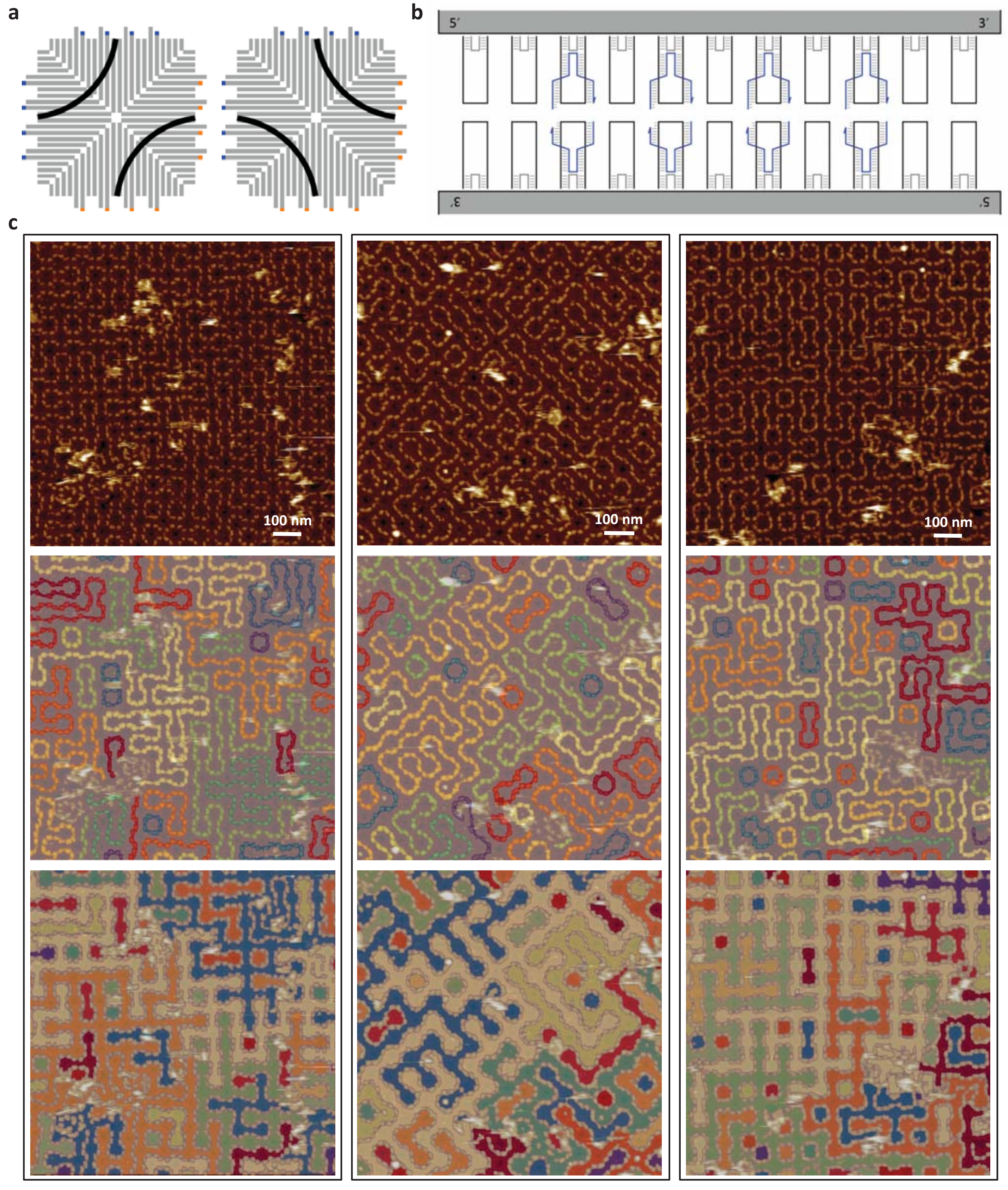


Figure S29: **Truchet arrays of arc tiles. a,** Tile abstraction. **b,** Edge design. **c,** Representative AFM images and their two renditions coloring the continuous paths on the lines and between the lines of surface modification, respectively. Sequences of staple strands are listed in Tables S2, S11 and S40.

S4.5 Analysis of arc pattern orientations

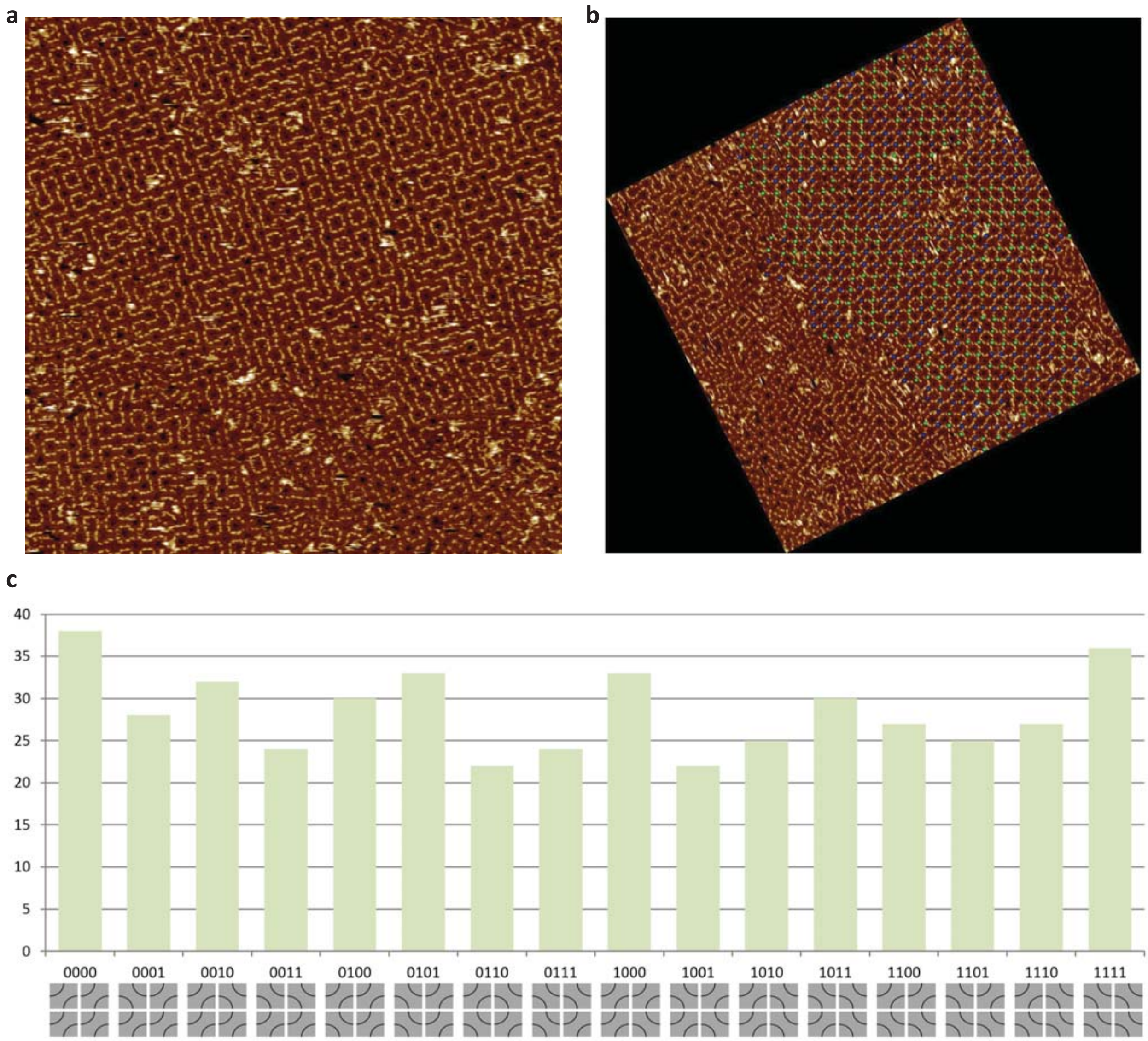


Figure S30: **Analysis of arc pattern orientations in Truchet arrays. a,** A representative AFM image of an unbounded DNA origami array with arc patterns in two orientations. **b,** Rotated AFM image with two orientations of the arc pattern labeled as blue and green dots, respectively. **c,** Numbers of all 16 possible patterns in a 2 by 2 neighborhood of tiles. With a total of 456 neighborhoods, each of the 16 patterns appeared 28.5 ± 4.9 times ($6.25\% \pm 1.07\%$).

S4.6 Unbounded arrays of arc tiles with extended edges

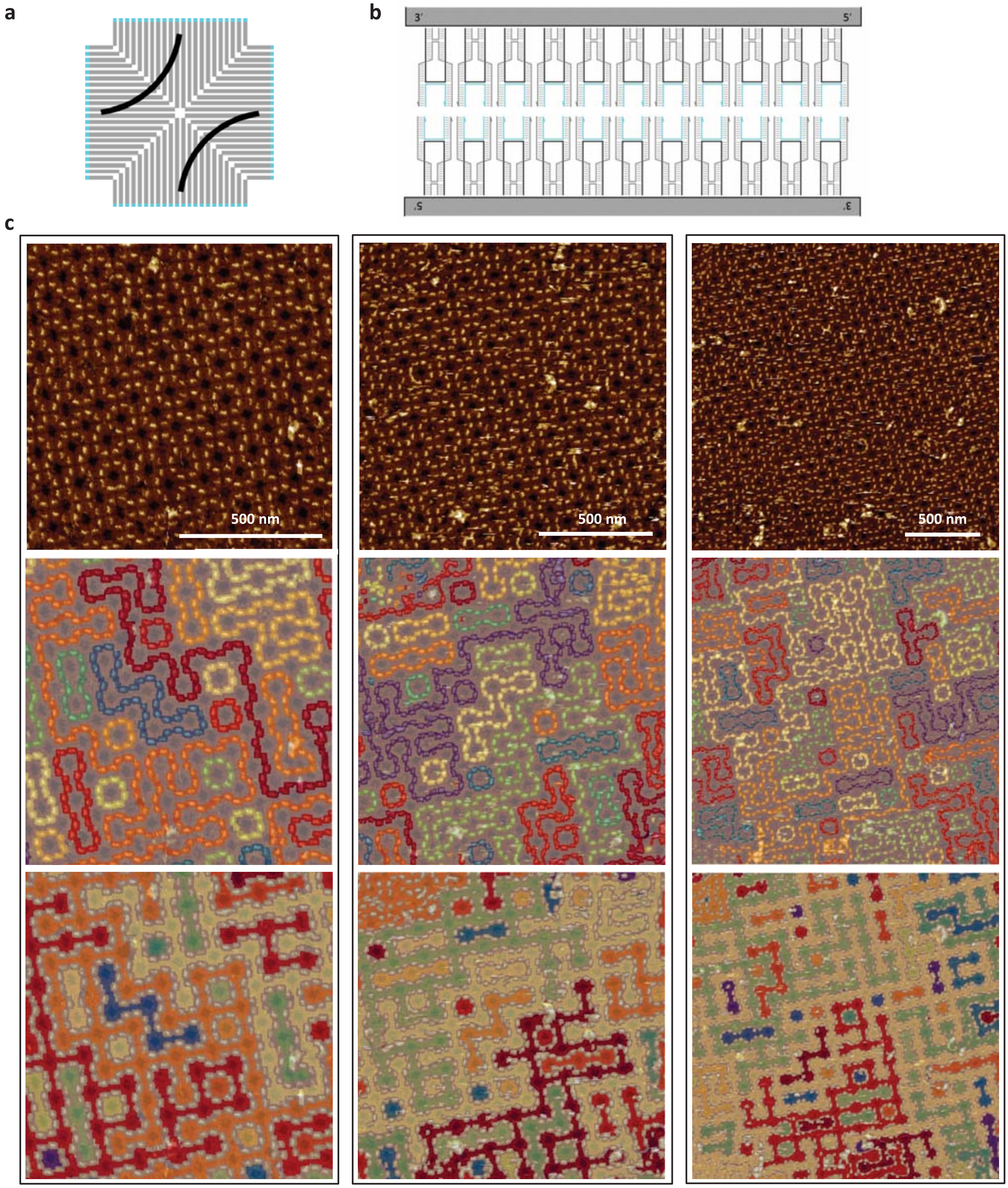


Figure S31: **Truchet arrays of arc tiles with extended edges. a,** Tile abstraction. **b,** Edge design. **c,** Representative AFM images and their two renditions coloring the continuous paths on the lines and between the lines of surface modification, respectively. Sequences of staple strands are listed in Tables S2, S5 and S40.

S5 Programming the tile

S5.1 Design of random maze patterns

The rule for defining patterns on a tile is $tile = Connect[((x_1, y_1),\ (x_2, y_2))\ @\ (cx_1, cy_1), \ldots]$. (x_i, y_i) defines the start and end points of a line. (cx_i, cy_i) defines the center of an arc. When @ is missing, the points are connected by a straight line.

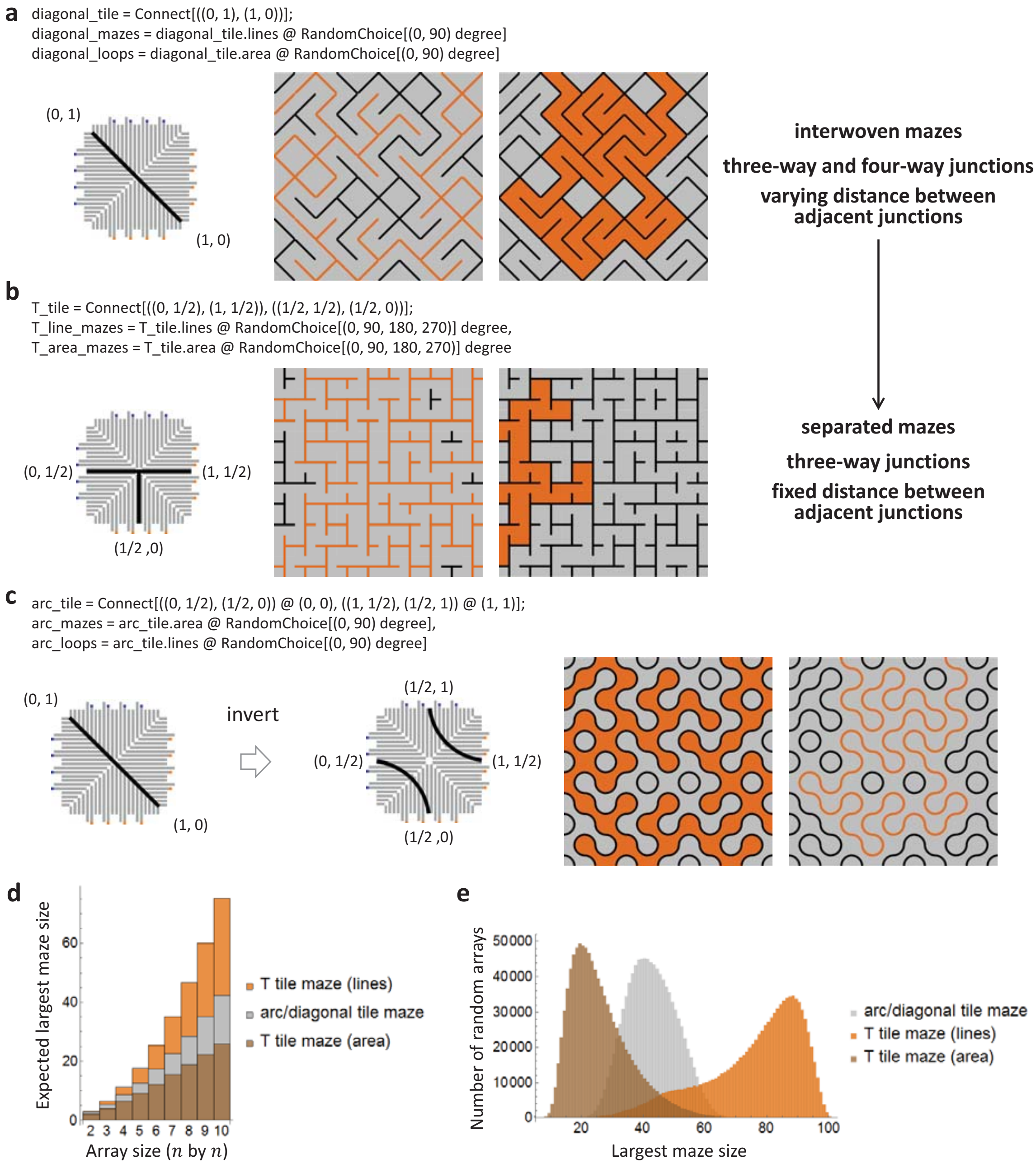


Figure S32: **Programming the tile to create maze-like patterns. a,** A diagonal tile design. **b,** A T tile design. **c,** An arc tile design. The largest maze or longest loop in each example random array is highlighted in orange. **d,** Average size of the largest mazes on random arrays from size of 2 by 2 to 10 by 10, generated from numerical simulations with ten thousand independent trials for each array size. **e,** Histogram of the largest maze size on random 10 by 10 arrays, generated from numerical simulations with a million independent trials.

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S5.2 Unbounded arrays of T tiles

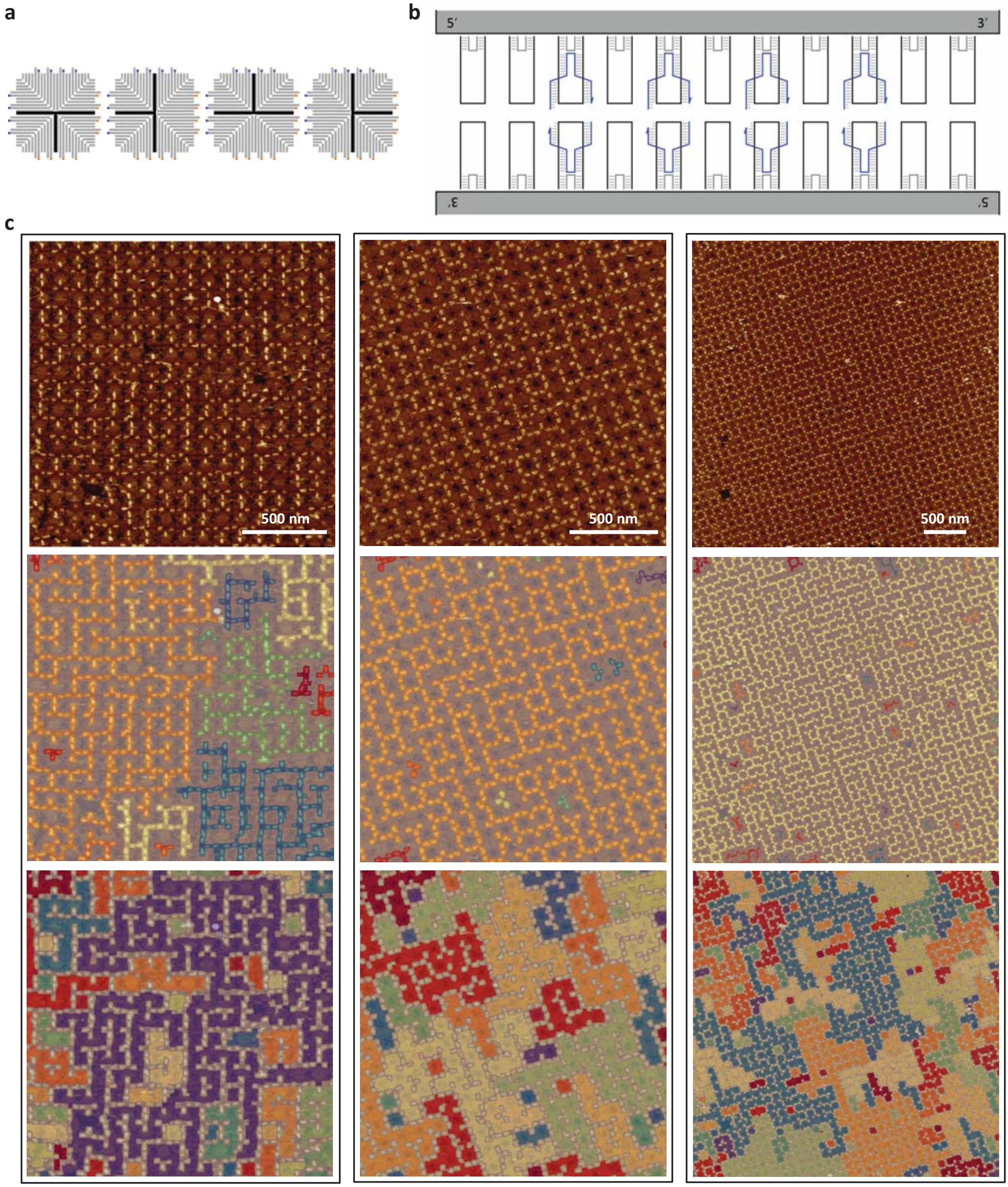


Figure S33: **Unbounded arrays of T tiles. a,** Tile abstraction. **b,** Edge design. **c,** Representative AFM images and their two renditions coloring the continuous paths on the lines and between the lines of surface modification, respectively. Sequences of staple strands are listed in Tables S2, S11 and S41.

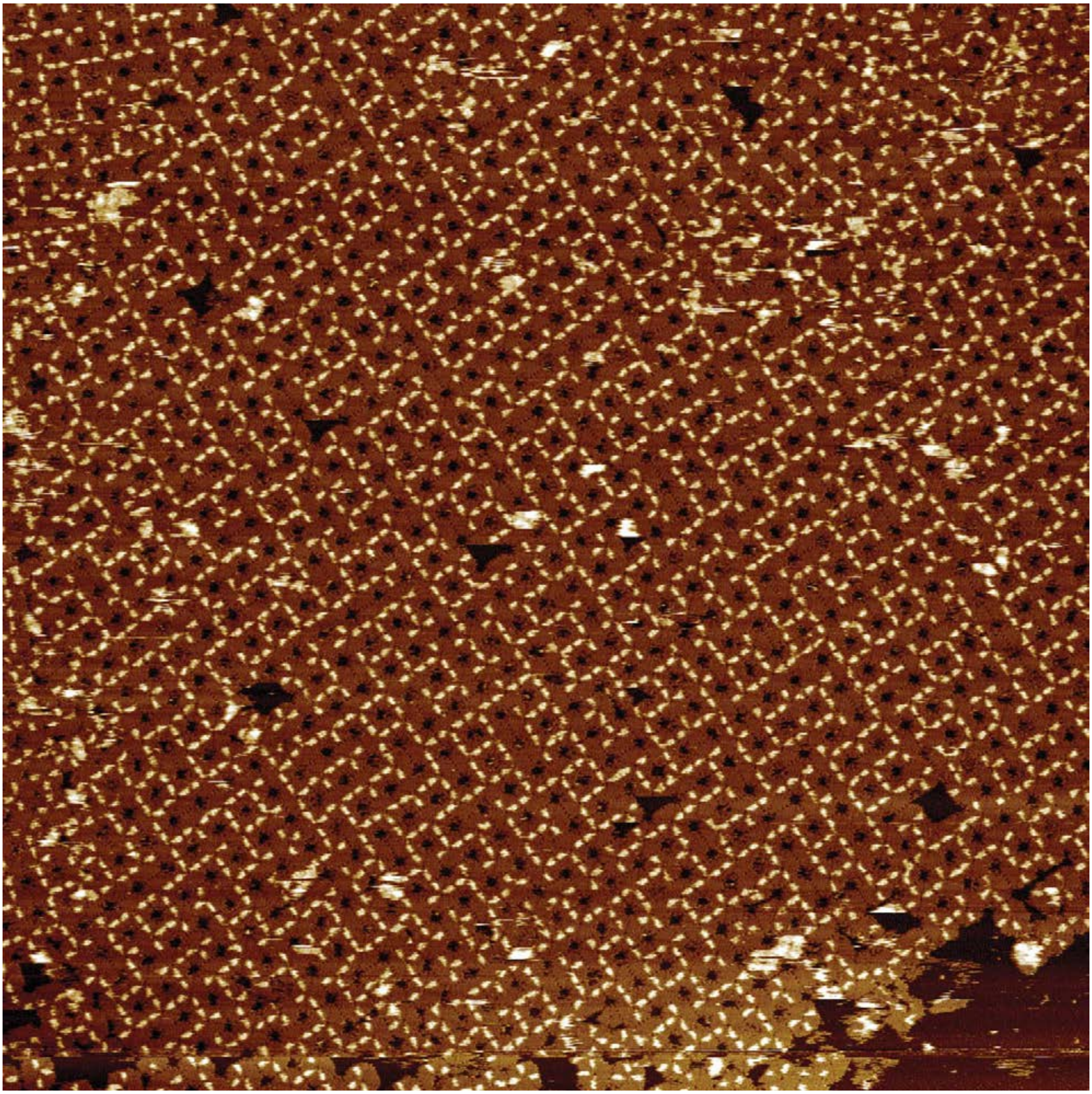


Figure S34: **A 2.8 by 2.8 μm AFM image of T tile arrays.**

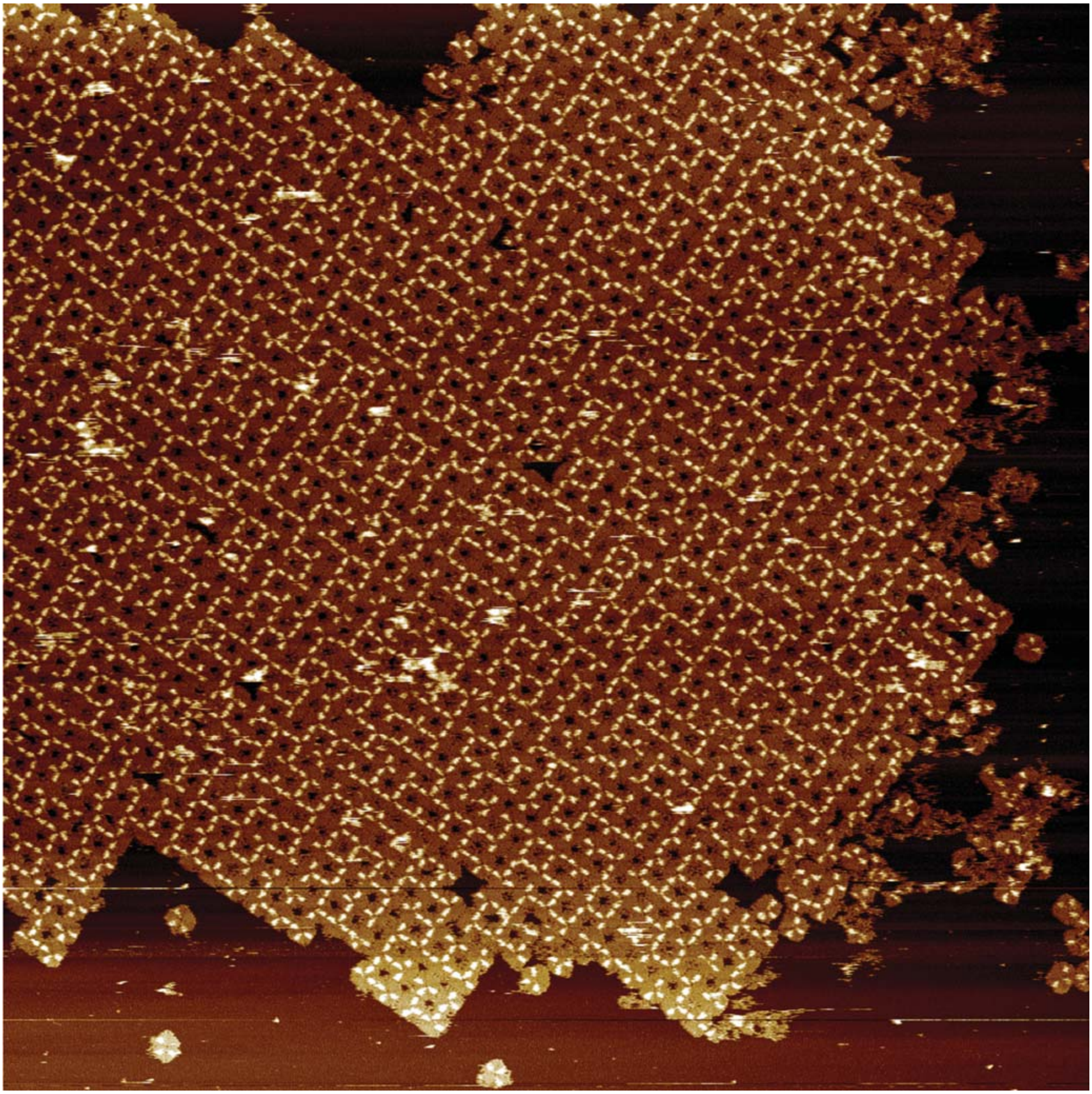


Figure S35: **A 3.5 by 3.5 μm AFM image of T tile arrays.**

S5.3 Analysis of arc loops and mazes in a 10 by 10 tile area

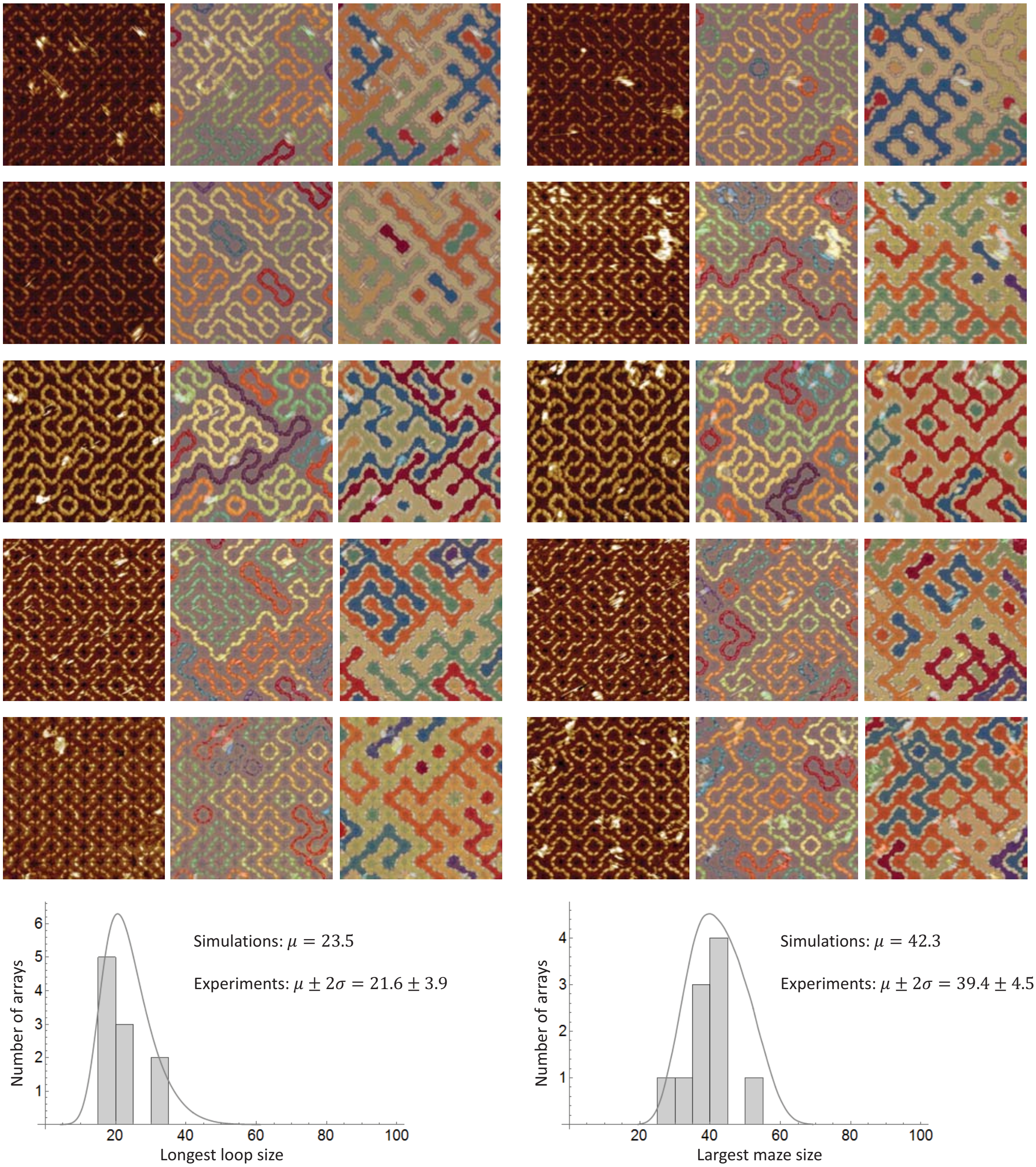


Figure S36: **Analysis of arc loops and mazes in a 10 by 10 tile area.** Sizes of the longest loops and largest mazes on each of the ten 10 by 10 tile areas in unbounded arc arrays is overlayed with the probability density function (scaled by 100) generated from numerical simulations. μ is the mean, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence. The number of circles is 3.8 ± 1.3 and the number of peanuts is 1.1 ± 0.6, agreeing with the expected numbers of circles $(m-1) \times (n-1) \times (\frac{1}{2}^4) = 5.06$ and peanuts $(m-2) \times (n-2) \times (\frac{1}{2}^6) = 1$ in a random $m = 10$ by $n = 10$ array,[13] within the statistical margin of error. The size of a circle is 2, and the total size of all loops on a 10 by 10 array is 100.

S5.4 Analysis of T mazes in a 10 by 10 tile area

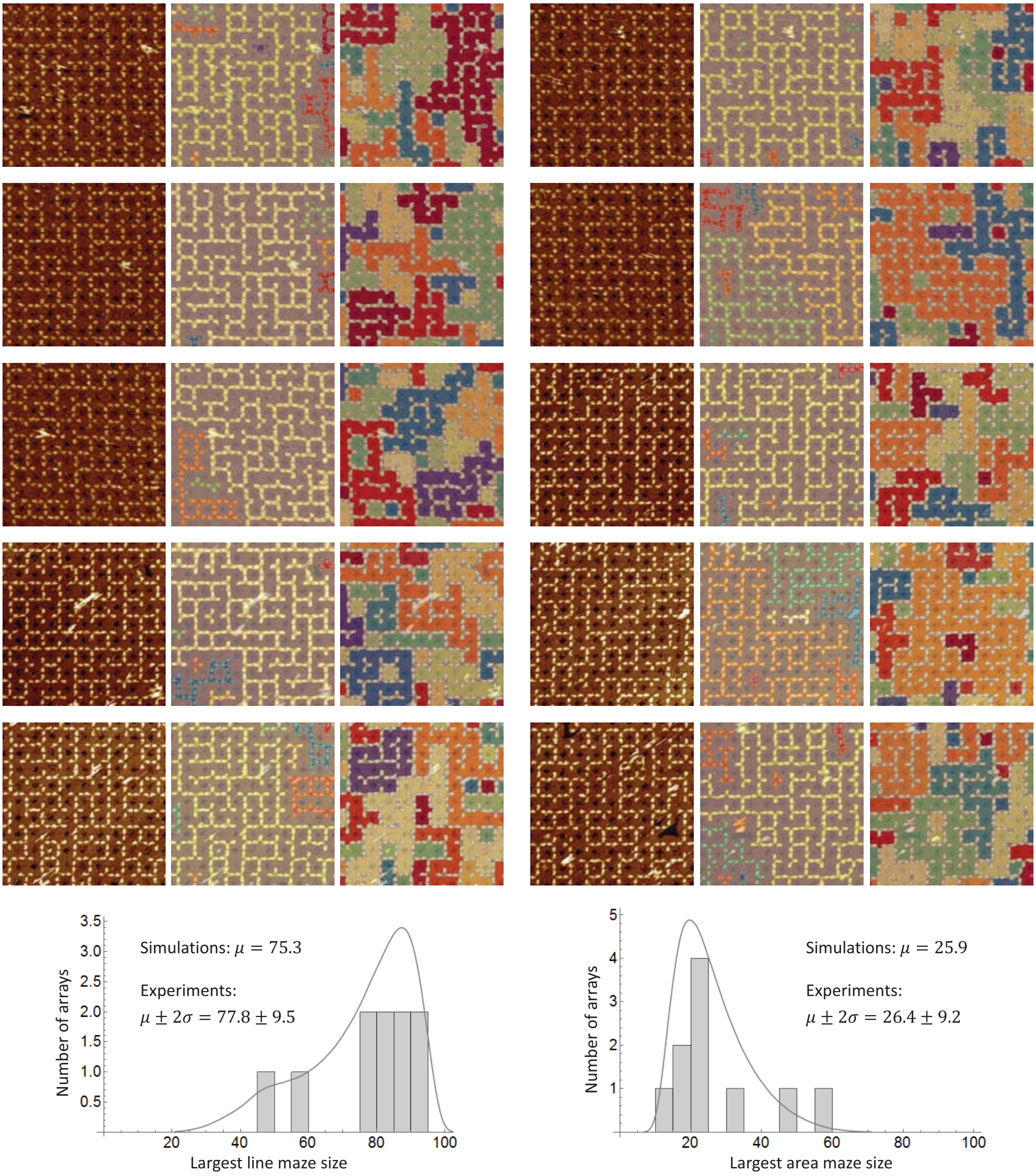


Figure S37: **Analysis of T mazes in a 10 by 10 tile area.** Sizes of the largest line mazes and largest area mazes on each of the ten 10 by 10 tile areas in T arrays is overlayed with the probability density function (scaled by 100) generated from numerical simulations. μ is the mean, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence. The size of a T line maze is determined as the number of tiles in the maze. The size of a T area maze is determined as the actual area in the maze, using the area of a single tile as 1. The total size of all mazes on a 10 by 10 array is 100.

S5.5 Example of more complex pattern designs

In the maze examples, only straight lines are needed to define the branching rules (e.g. the arc tile can be replaced by two straight lines connecting the same points and the configuration of mazes would stay the same). But if we consider not only where the lines are connected within and across tiles, but also how they are connected in terms of the exact curvature, more complex geometry can be created. For example, with a tile design that allows a larger circle connected by eight tiles centered in a 3 by 3 neighborhood and a smaller circle connected by two tiles when they are 180° rotated from each other, global patterns that resemble fish and gears will emerge (Fig. S38).

```
fishgear_tile = Connect[((0, 1/3), (1, 1/3)) @ (1/2, -1/2), ((1/3, 0), (2/3, 0)) @ (1/2, 0),
                        ((0, 2/3), (1/3, 1)) @ (-1/2, 3/2), ((2/3, 1), (1, 2/3)) @ (3/2, 3/2)];
fishgear_array = fishgear_tile @ RandomChoice[(0, 90, 180, 270) degree]
```

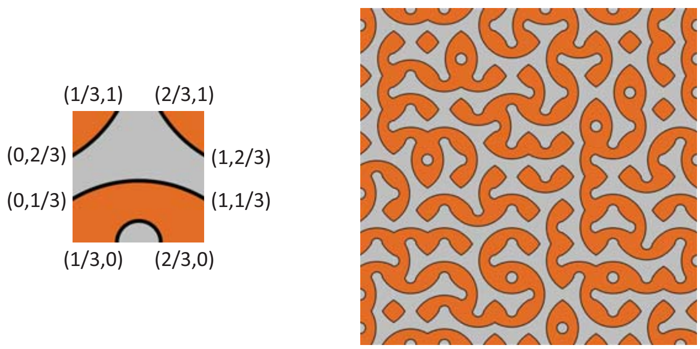


Figure S38: **A tile design that creates "fish and gear" patterns.** Designed by Stella Wang, an undergraduate student in Bioengineering at Caltech.

S6 Programming the grid

S6.1 Design of random tree patterns

The rule for defining a grid is $grid[(i,j),\ tile] = [\text{If } cond_1(i,j),\ tile\ @\ orient_1; \ldots]$. (i,j) indicates a location on the grid. $cond_i$ defines a set of specific locations on the grid, as a function of (i,j). $orient_i$ defines the orientation of a tile at $cond_i$ on the grid. The default grid is $grid[(i,j),\ tile] = [tile\ @\ 0\ \text{degree}]$, which has the same orientation of tiles at all locations.

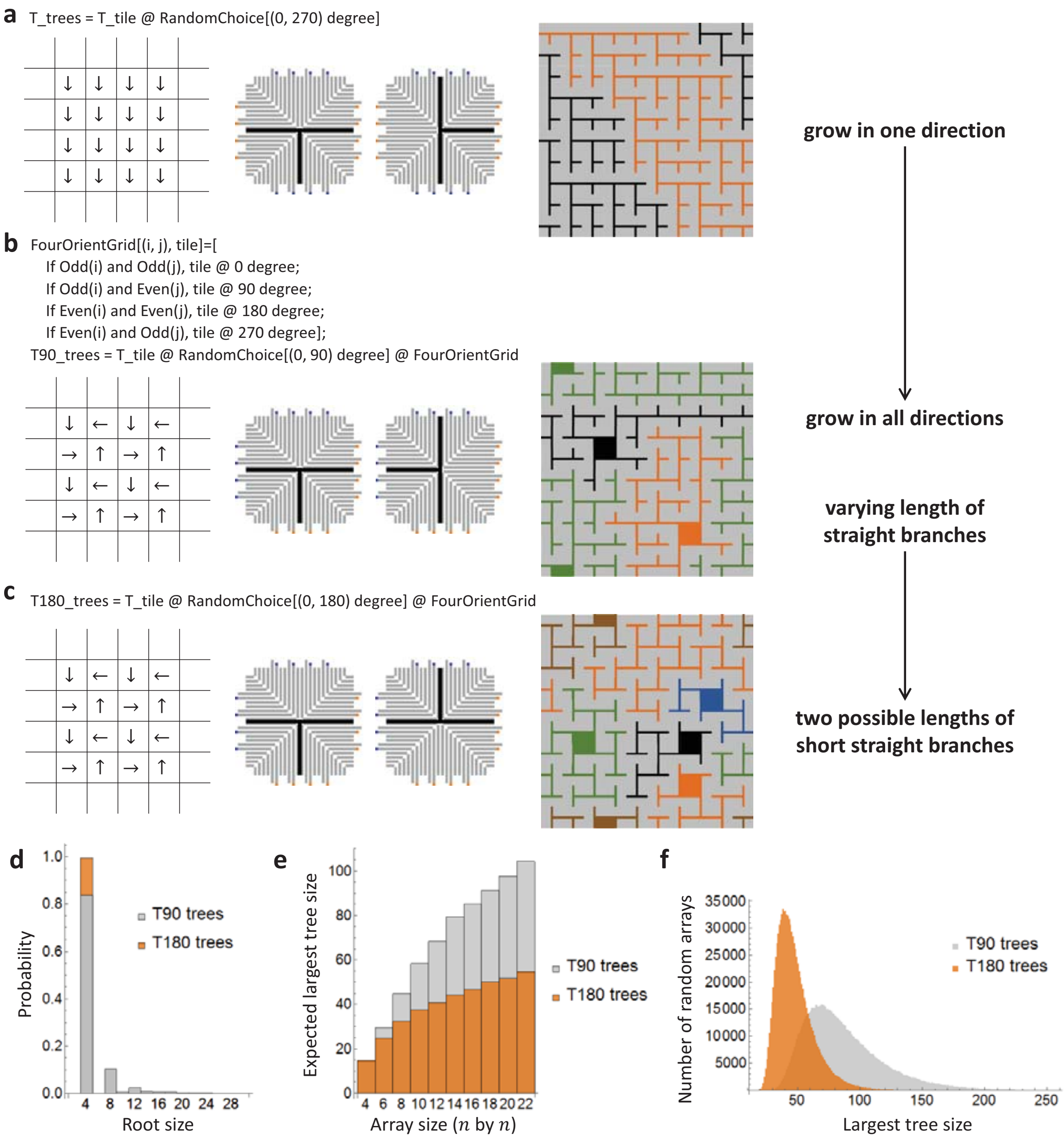


Figure S39: **Programming the grid to create tree-like patterns that grow in all directions. a,** A T tile design on the default grid. **b** and **c,** two T tile designs on a four-orientation grid. Individual trees in each example random array, on a torus, are shown in distinct colors. The "root" of each tree is filled with the same color as the branches. **d,** Probability of root size on random 10 by 10 arrays, generated from numerical simulations with ten thousand independent trials. **e,** Average size of the largest trees on random arrays from size of 4 by 4 to 22 by 22, generated from numerical simulations with ten thousand independent trials for each array size. **f,** Histogram of the largest tree size on random 16 by 16 arrays, generated from numerical simulations with a million independent trials.

S6.2 Unbounded arrays of T90 tiles on a four-orientation grid

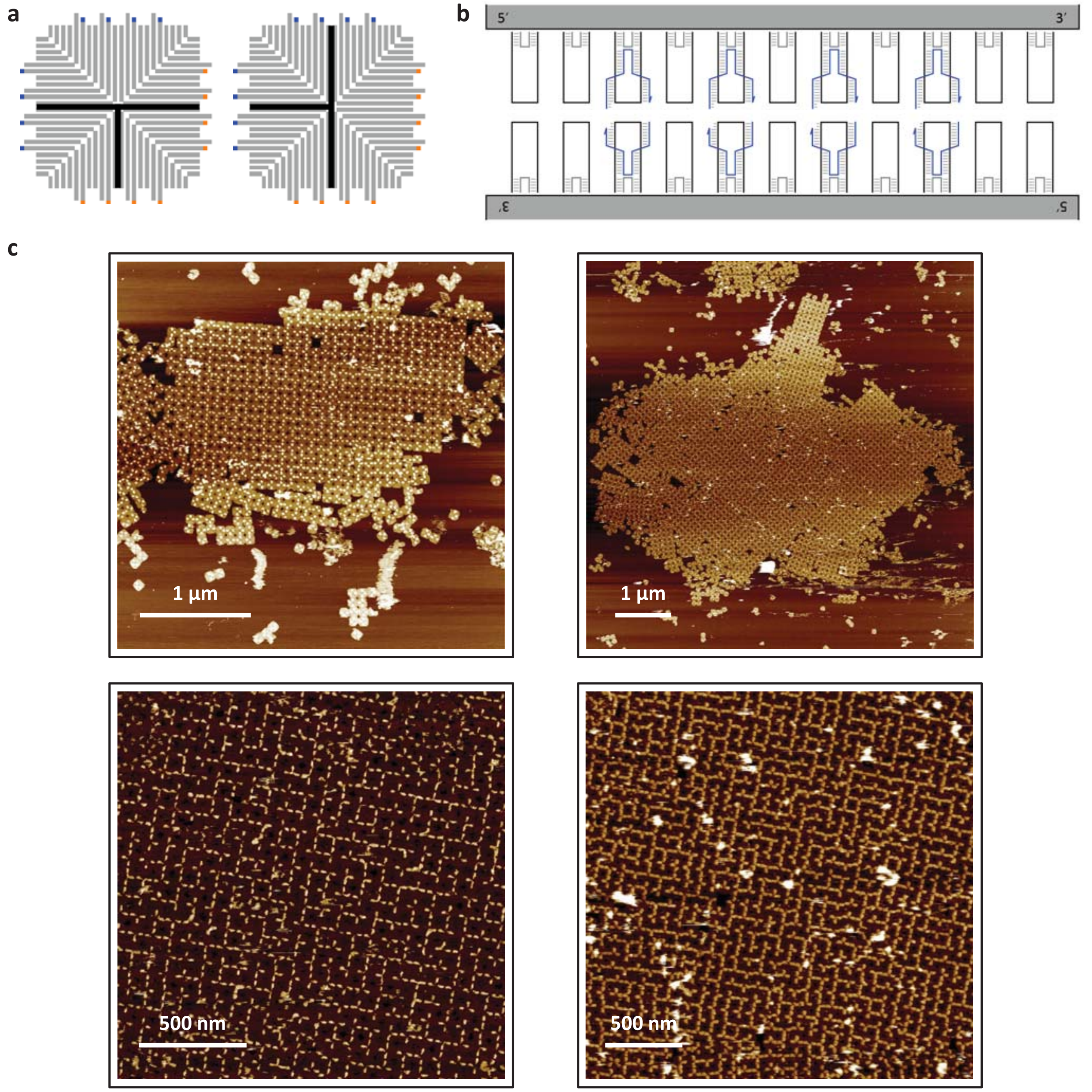


Figure S40: **Unbounded arrays of T90 tiles on a four-orientation grid. a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. Sequences of staple strands are listed in Tables S2, S11 and S41.

S6.3 Unbounded arrays of T180 tiles on a four-orientation grid

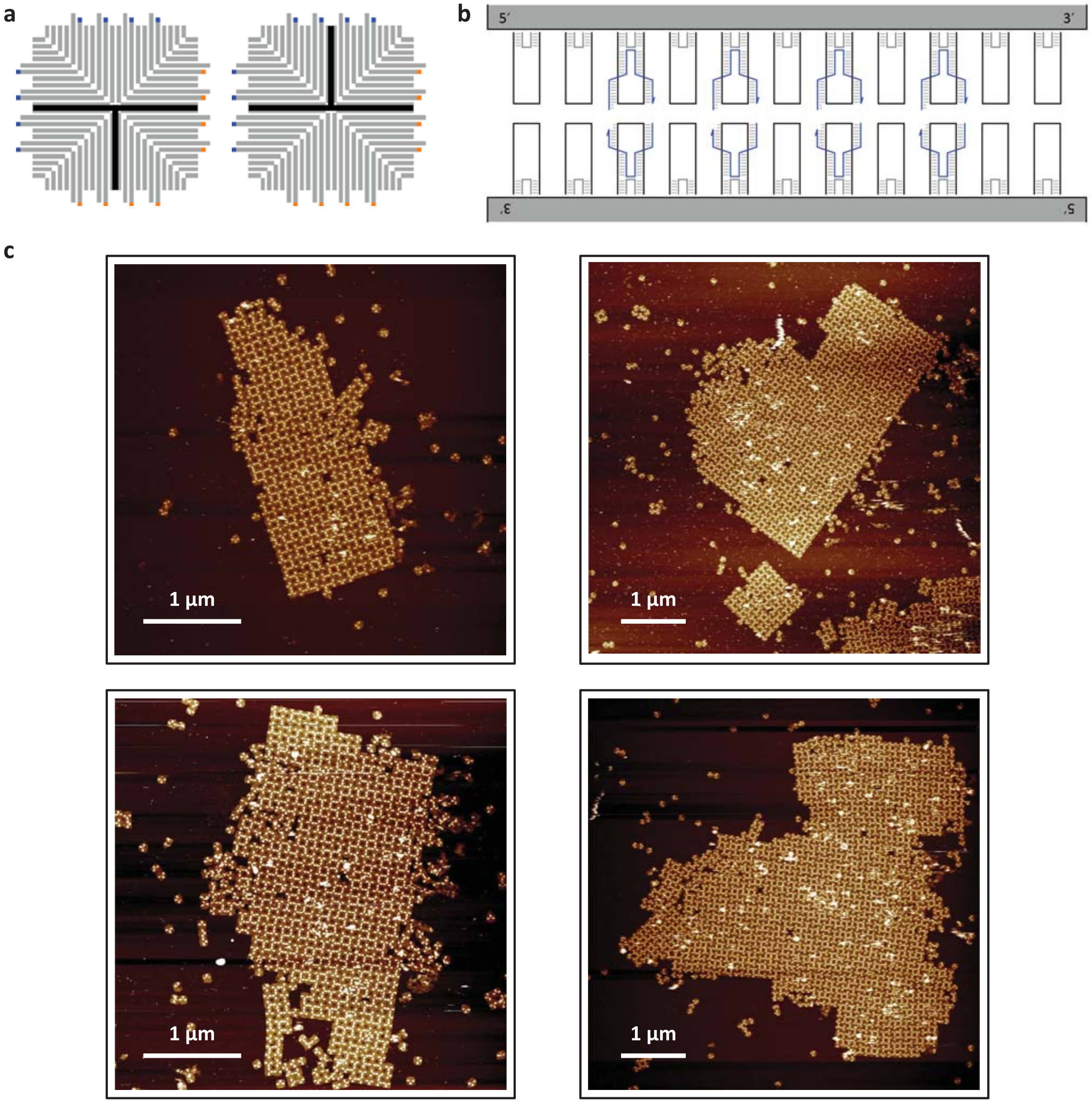


Figure S41: **Unbounded arrays of T180 tiles on a four-orientation grid. a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. Sequences of staple strands are listed in Tables S2, S11 and S41.

S6.4 Analysis of T90 and T180 trees in a 10 by 10 tile area

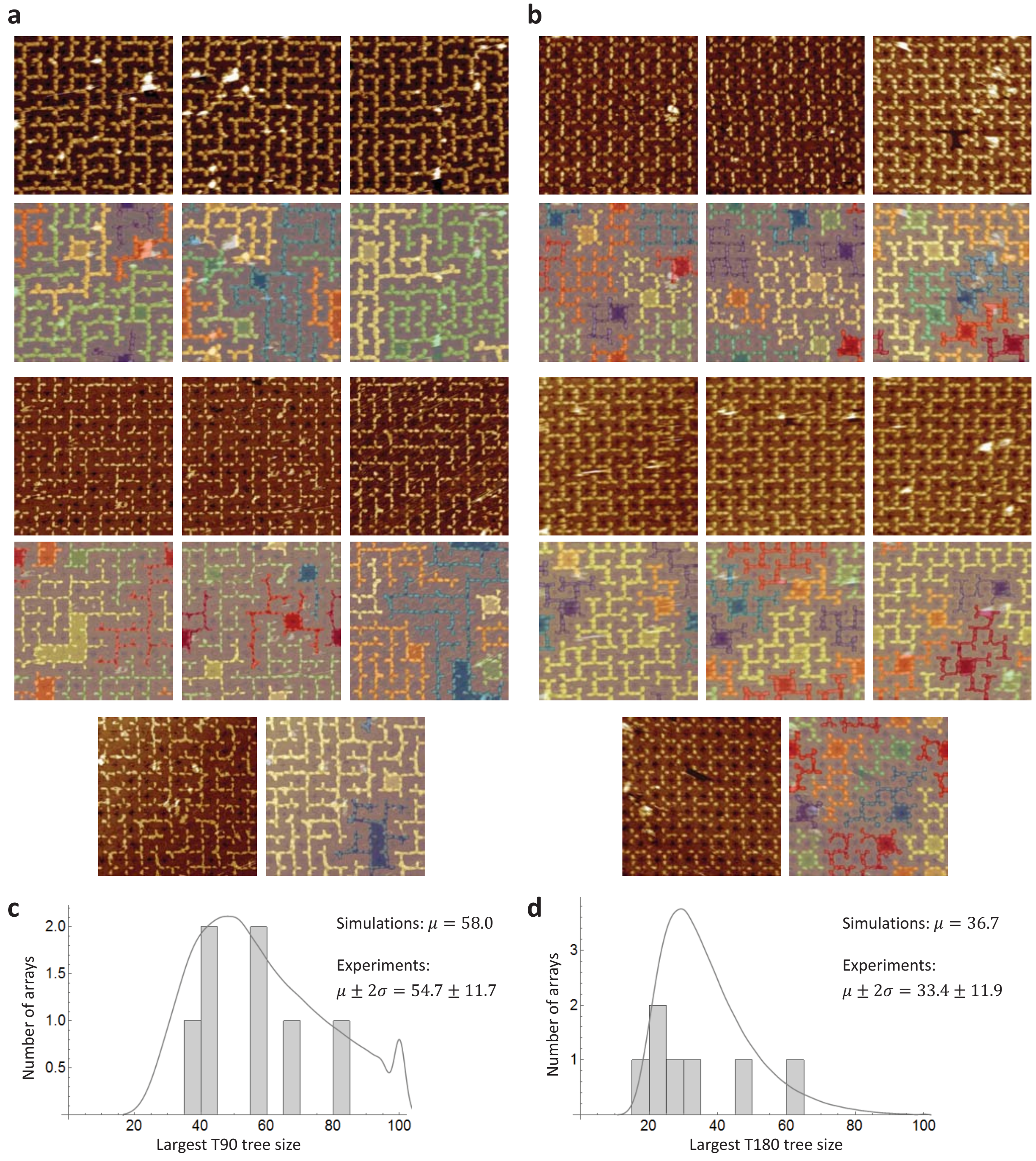


Figure S42: **Analysis of T90 and T180 trees in a 10 by 10 tile area.** **a** and **b,** AFM images of random trees on T90 and T180 tile arrays. **c** and **d,** Sizes of the largest T90 and T180 trees on each of the seven 10 by 10 tile areas in T90 and T180 arrays is overlayed with the probability density function (scaled by 100) generated from numerical simulations. μ is the mean, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence.

S7 Programming the random choice

S7.1 Design of random loops, mazes and trees with tunable size distributions

The first rule for defining a random choice is *tile* @ $RandomChoice[(p_1, p_2, \ldots) \to (orient_1,\ orient_2, \ldots)]$, $\sum p_i = 1$. p_i is the probability of $orient_i$. The default probability is $1/n$, where n is the total number of choices. The default orientation is 0 degree.

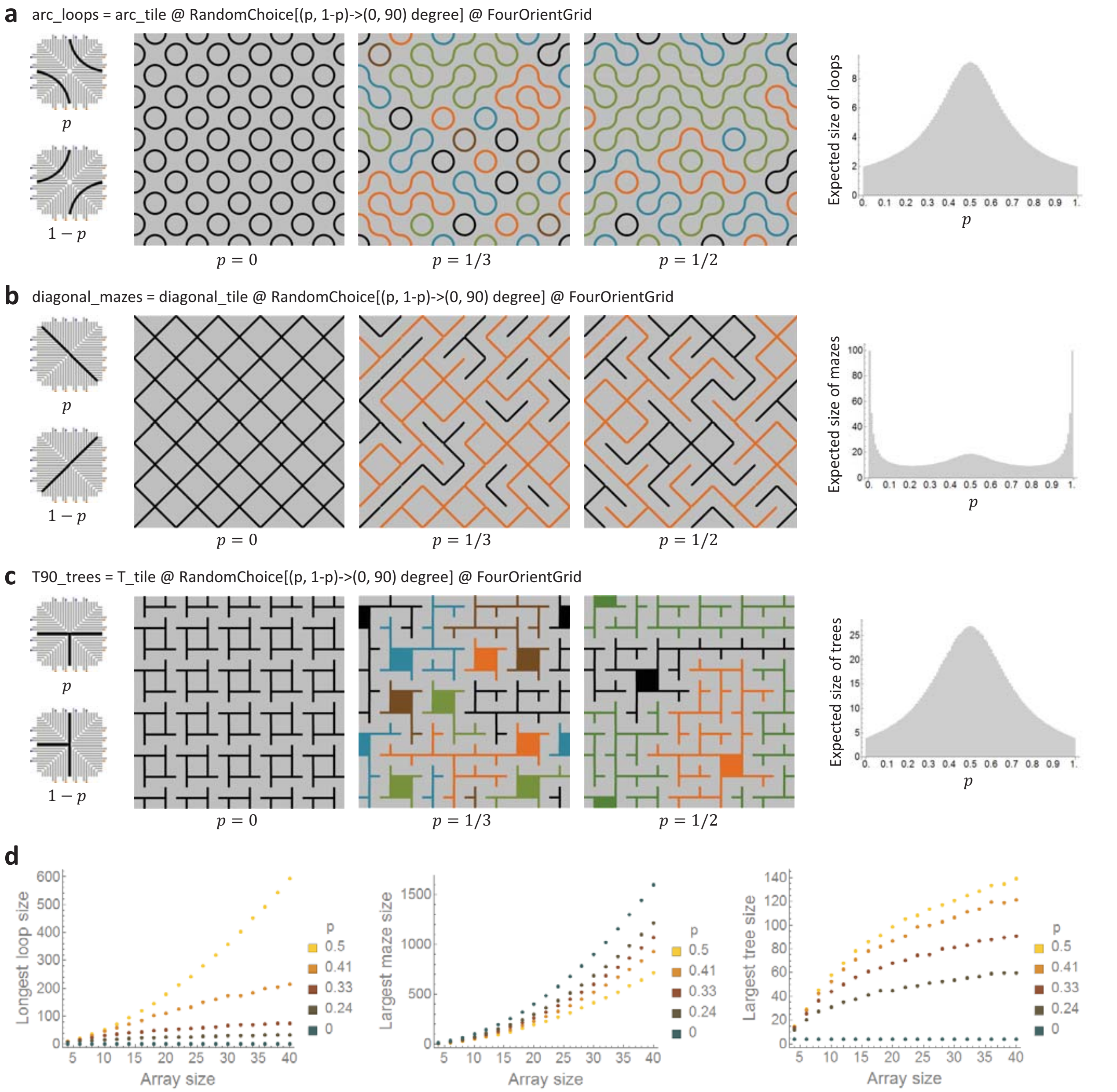


Figure S43: **Programming the random choice to control the size of loops, mazes and trees. a**, **b** and **c,** Random loops, mazes and trees with the size controlled by the probabilities of two tiles with distinct pattern orientations. Expected size of loops, mazes and trees on random 10 by 10 arrays were generated from numerical simulations with ten thousand independent trials for each p from 0 to 1 with 0.01 increment. **d,** Average sizes of the longest loops, largest mazes and trees on random arrays from size of 4 by 4 to 40 by 40, with $p = 0$, 0.24, 0.33, 0.41 and 0.5, generated from numerical simulations with one thousand independent trials for each array size with each p value.

S7.2 Design of random loops with tunable number of crossings

The second rule for defining a random choice is $RandomChoice[(p_1, p_2, \ldots) \rightarrow (tile_1 @ orient_1,\ tile_2 @ orient_2, \ldots)]$, $\sum p_i = 1$. p_i is the probability of $tile_i$ @ $orient_i$. The default probability is $1/n$, where n is the total number of choices. The default orientation is 0 degree.

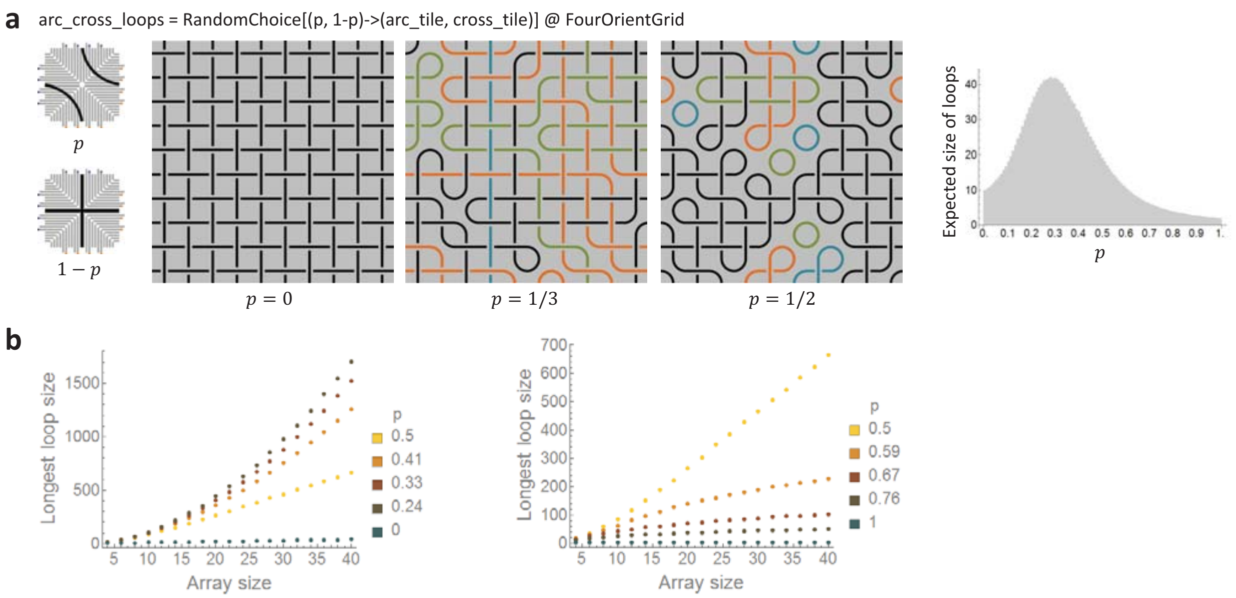


Figure S44: **Programming the random choice to control the number of crossings in random loops. a,** Random loops with the size and number of crossings controlled by the probabilities of two tiles with distinct patterns. Expected size of loops on random 10 by 10 arrays were generated from numerical simulations with ten thousand independent trials for each p from 0 to 1 with 0.01 increment. **b,** Average size of the longest loops on random arrays from size of 4 by 4 to 40 by 40, with p = 0, 0.24, 0.33, 0.41, 0.5, 0.59, 0.67, 0.76 and 1, generated from numerical simulations with ten thousand independent trials for each array size with each p value.

S7.3 Unbounded arrays of T90 tiles with $p = 0$ and $1/3$

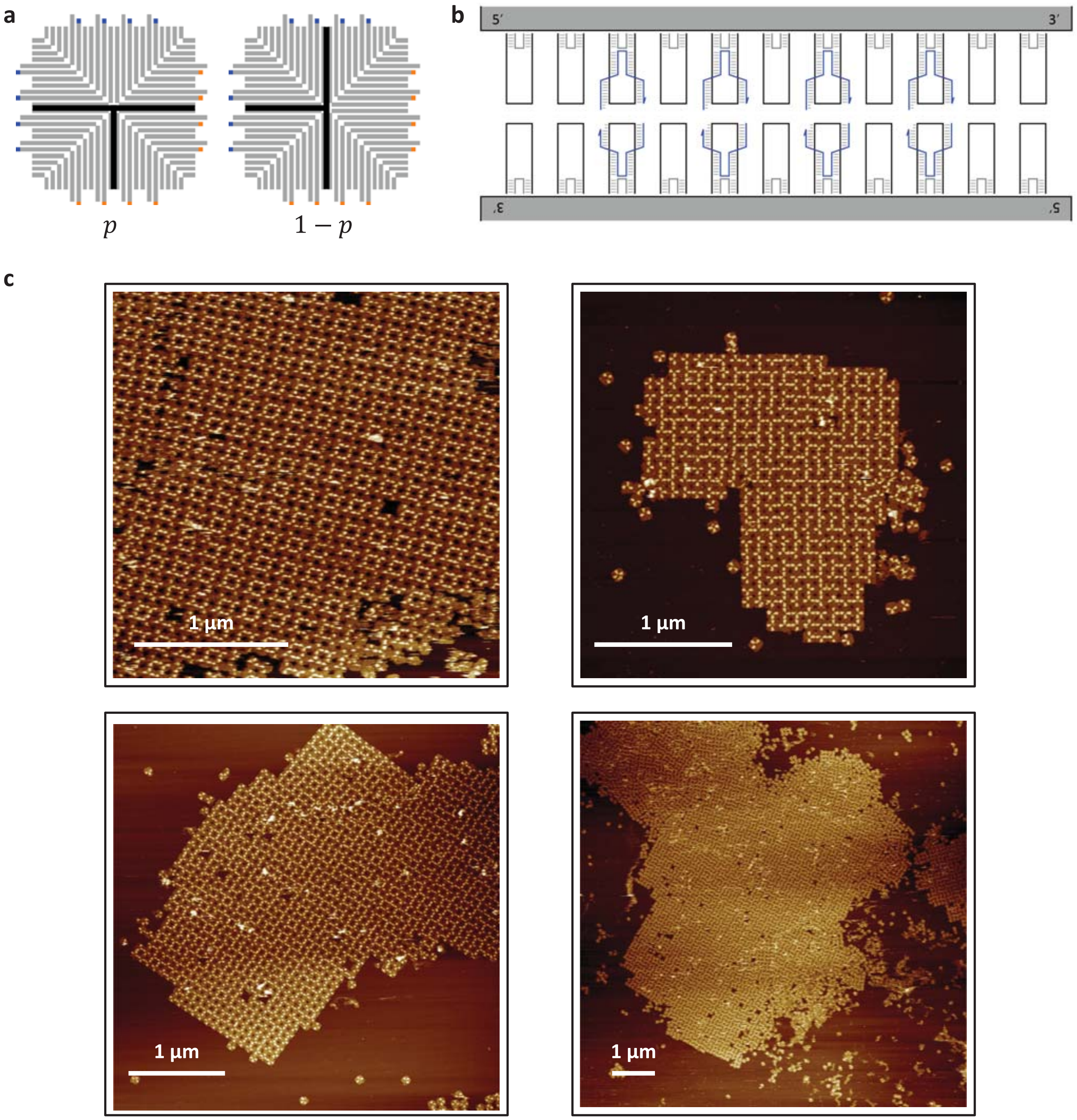
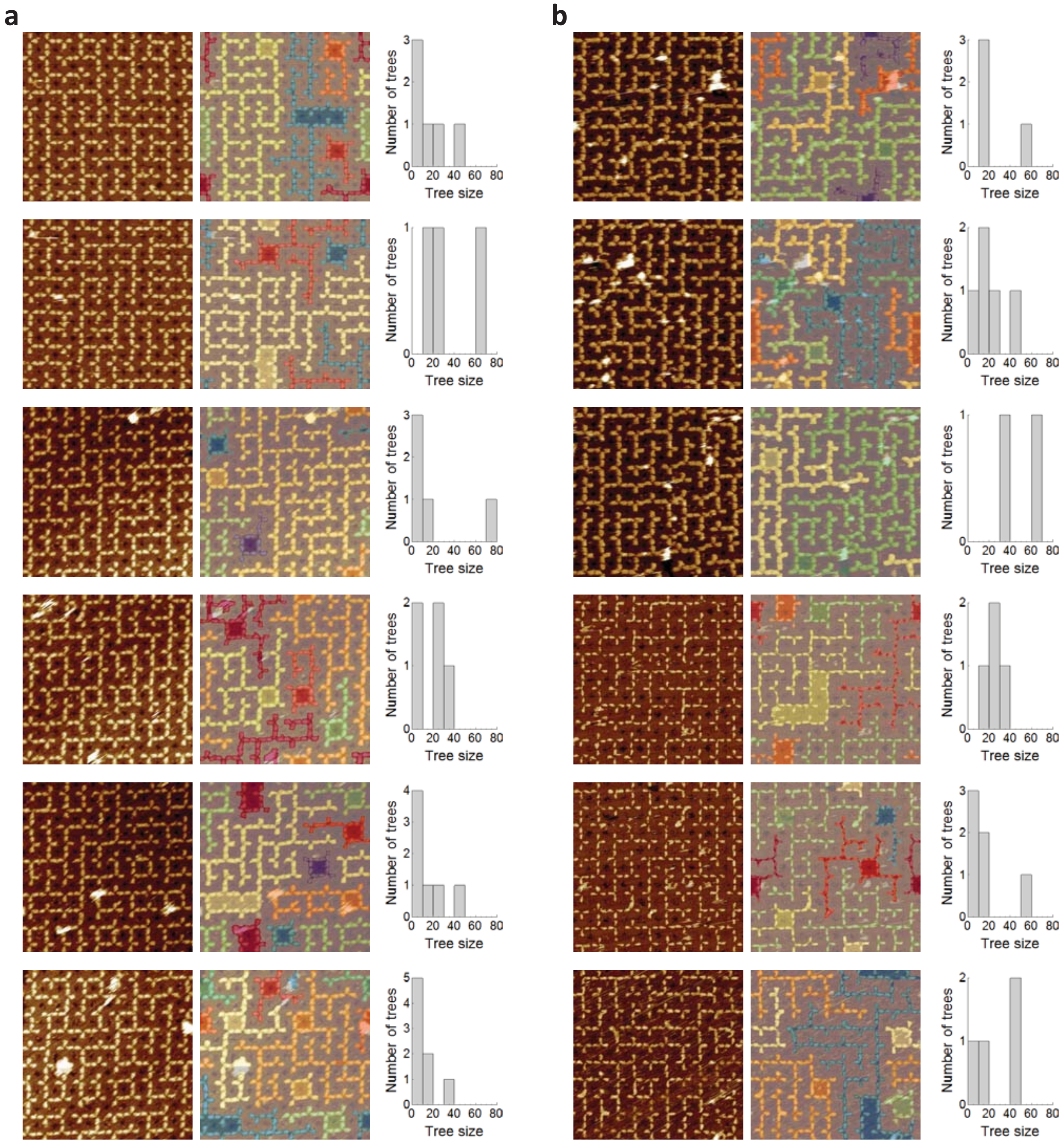


Figure S45: **Unbounded arrays of T90 tiles with $p = 0$ and $1/3$. a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. Top left image: $p = 0$. Top right and bottom images: $p = 1/3$. Sequences of staple strands are listed in Tables S2, S11 and S41.

S7.4 Analysis of T90 trees in a 10 by 10 tile area



Simulations: $\mu = 16.7$

Experiments: $\mu \pm 2\sigma = 17.6 \pm 5.8$

Simulations: $\mu = 26.7$

Experiments: $\mu \pm 2\sigma = 25.9 \pm 8.0$

Figure S46: **Analysis of T90 trees in a 10 by 10 tile area. a,** $p = 1/3$. **b,** $p = 1/2$. AFM images in (b) are the same as shown in Fig. S42a, but here the sizes of all trees instead of only the largest trees are analyzed. The last image in Fig. S42a is omitted here, but μ and σ were calculated using all seven images. μ is the average size of all T90 trees, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence.

S7.5 Unbounded arrays of arc and cross tiles with $p = 0$, $1/3$ and $1/2$

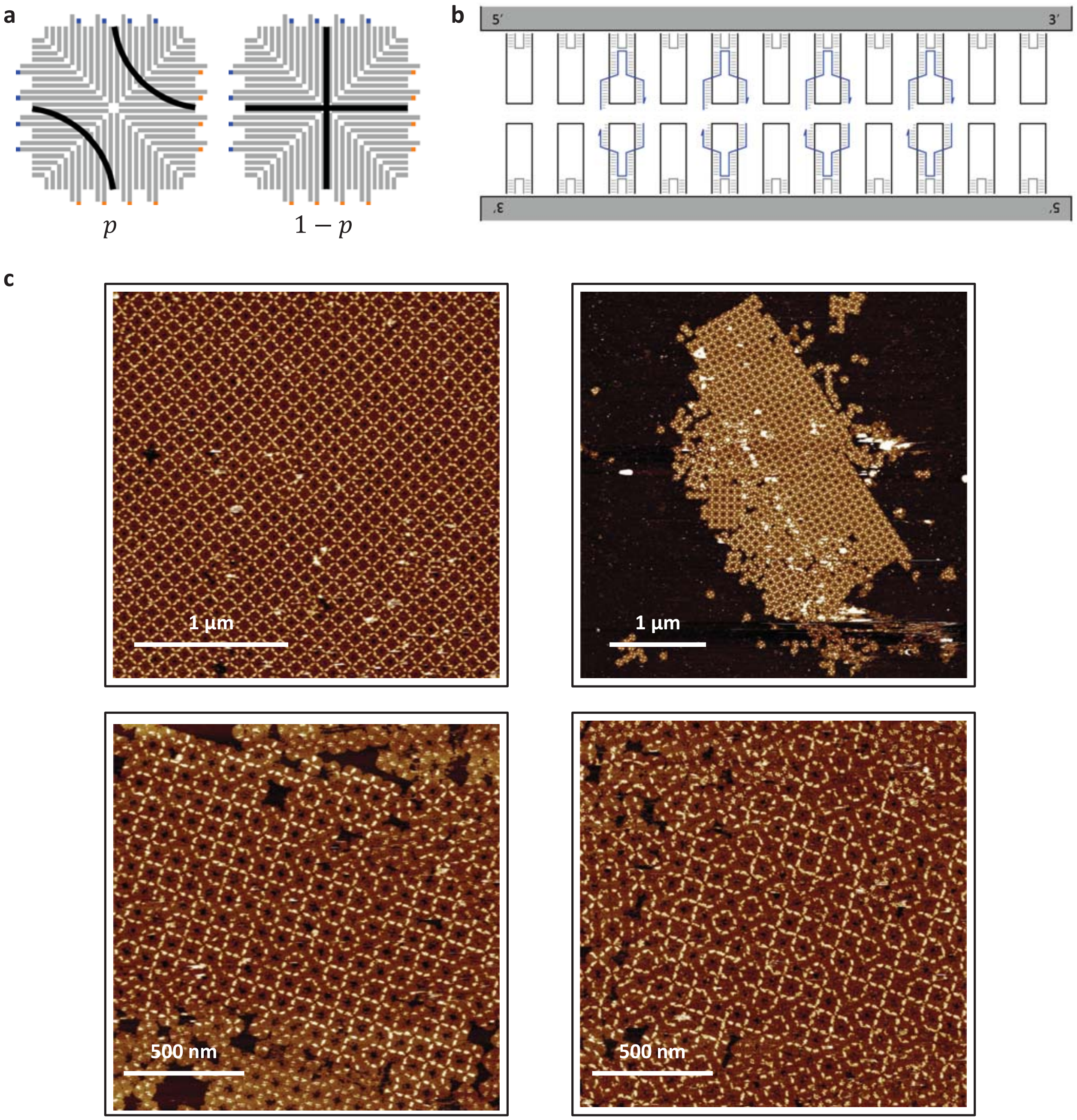
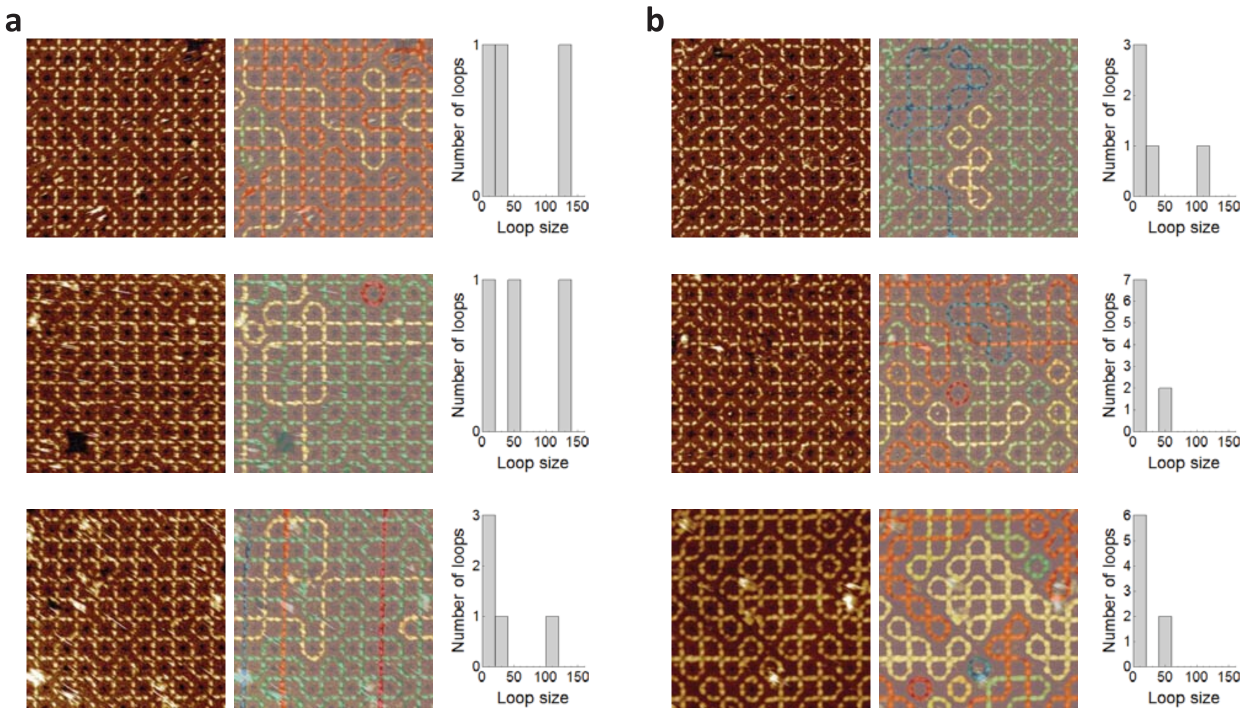


Figure S47: **Unbounded arrays of arc and cross tiles with $p = 0$, $1/3$ and $1/2$. a,** Tile abstraction, **b,** Edge design, and **c,** AFM images. Top images: $p = 0$. Bottom left image: $p = 1/3$. Bottom right image: $p = 1/2$. Sequences of staple strands are listed in Tables S2 and S11, Arc1-TiRjCk (all i, j and k) in Table S40, and Table S41.

S7.6 Analysis of loops with crossings in a 10 by 10 tile area



Average size of all loops (simulations): $\mu_L = 40.2$ $\mu_L = 19.3$

Average size of all loops (experiments): $\mu_L \pm 2\sigma_L = 46.5 \pm 14.1$ $\mu_L \pm 2\sigma_L = 20.3 \pm 8.9$

Average number of crossings (theory): $\mu_C = 67$ $\mu_C = 50$

Average number of crossings (experiments): $\mu_C \pm 2\sigma_C = 70.3 \pm 7.4$ $\mu_C \pm 2\sigma_C = 48.7 \pm 4.4$

Figure S48: **Analysis of loops with crossings in a 10 by 10 tile area. a,** $p = 1/3$. **b,** $p = 1/2$. μ_L is the average size of all loops, μ_C is the average number of crossings, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence.

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S8 Programming a finite grid

S8.1 Finite array design

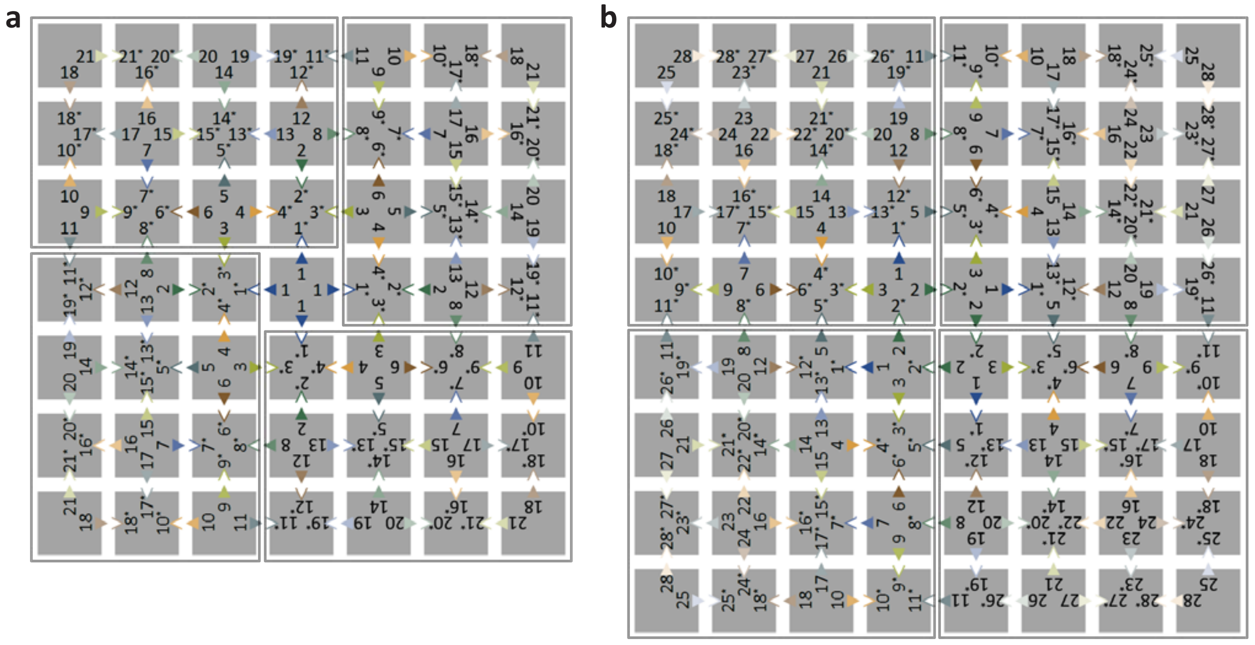

Figure S49: **Fully connected design of an $n \times n$ array. a,** $n = 7$ and **b,** $n = 8$. This design requires $n^2/4 + O(1)$ distinct types of tiles and $n(n-1)/2$ distinct pairs of edges. More specifically, it requires $(n^2-1)/4+1$ distinct types of tiles when n is odd, and $n^2/4$ distinct types of tiles when n is even. In this design, the arrays are fully connected, meaning every interior tile is attached to its neighbors on all four sides, every edge tile is attached on three sides and every corner tile attached on two sides. Because the origami tiles can rotate and attach to each other, the tiles in the top left quarter of each array are rotated 90° counter-clockwise three times to fill in the bottom left, bottom right and top right quarters.

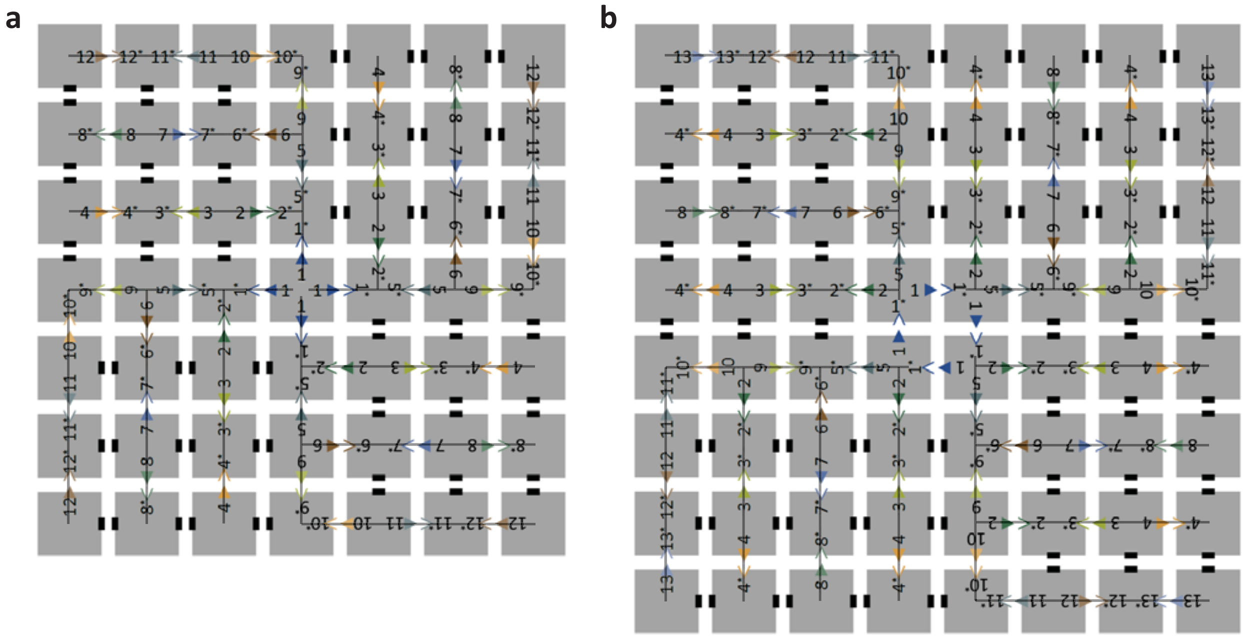

Figure S50: **Comb design of an $n \times n$ array. a,** $n = 7$ and **b,** $n = 8$. This design requires $2n + O(1)$ distinct types of tiles and pairs of edges. More specifically, when $n \leq 7$, it requires $(n^2 - 1)/4 + 1$ distinct types of tiles and $(n^2 - 1)/4$ distinct pairs of edges when n is odd, and $n^2/4$ distinct types of tiles and edges when n is even. When $n > 7$, it requires $2n - 1$ distinct types of tiles and $2n - 2$ distinct pairs of edges when n is odd, and $2n - 3$ distinct types of tiles and edges when n is even. In this design, each quarter of an array is connected like a comb structure,[14] and the top left quarter is again rotated three times to fill in the shape. We used two staples each with two stacking bonds to provide a weak stabilizing interaction (shown as black bars) between any unconnected edges in the interior of an array. Because each tooth of the comb structure can be constructed with the same set of tiles, compared to the fully-connected design, this design uses a significantly smaller number of distinct types of tiles and edges when n is large. We chose to use a different set of tiles for the tooth near the edge of an array – these tiles have a stabilizing edge on one side but an inert edge on the other, so that the finite arrays are protected from aggregating into larger structures. We also chose to use two alternating sets of tiles for the interior teeth, so that the tiles in the backbone of the comb structure can alternate between all giving edges and all receiving edges to minimize spurious edge interactions among different copies of the same tile type (the first criterion for designing edge interactions, as discussed in supplementary note S8.2). When n is even, there are four copies of the same center tile that need to connect with each other, and thus they have both giving and receiving edges.

An important feature of the fully connected design is that a complete assembly is preferred over an incomplete assembly, because any incomplete assembly will have some tiles not attached by all possible sides thus is thermodynamically less favorable. In the comb design, other than the weak stabilizing interactions, every tile would always attach to an existing assembly by just one side during the process of self-assembly, and thus a complete assembly does not have much of an advantage over incomplete ones.

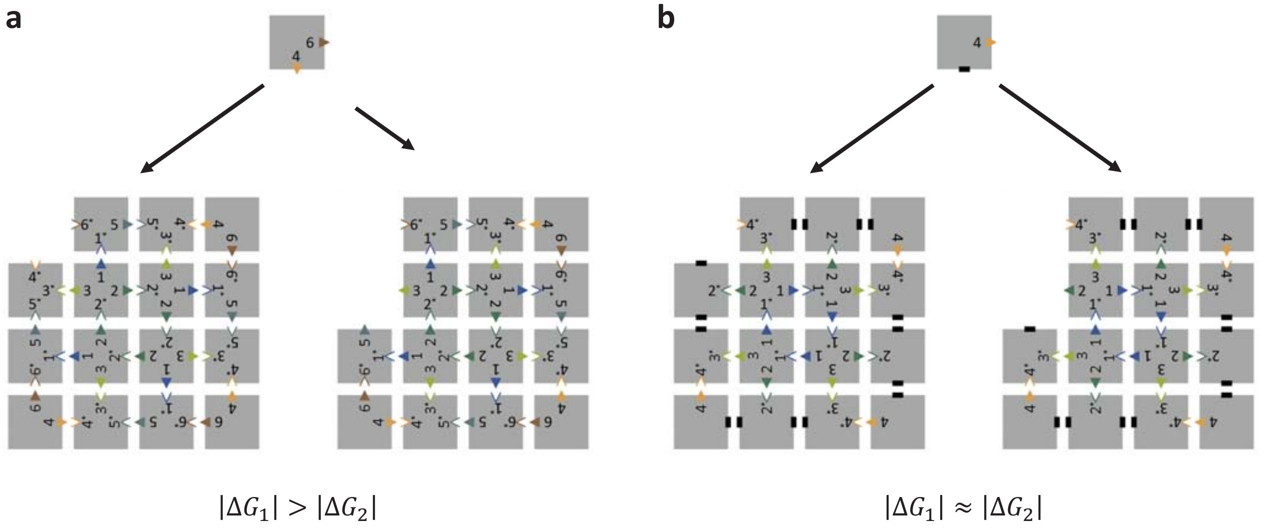

Figure S51: **Comparing the difference in preferred assemblies of the two finite array designs. a,** The fully connected design encourages complete assemblies over incomplete ones. **b,** The comb design does not encourage complete assemblies over incomplete ones.

S8.2 Edge design

There are four criteria that we established for designing all edge interactions. First, minimize spurious edge interactions among different copies of the same tile type. Each pair of edge interactions (e.g. 1 and 1*) can be programmed with short sticky ends through extensions and truncations on edge staples, which we call a giving edge (e.g. 1) and a receiving edge (e.g. 1*), respectively. While a giving edge and its own receiving edge are designed to be complementary, the worst spurious interactions typically arise between a giving edge and a non-complementary receiving edge when some sequence similarity of sticky ends occurs. Thus we chose to design individual tiles with either all giving edges or all receiving edges whenever possible, such that when origami tiles are annealed to form monomers, the spurious interactions will be insufficient to cause aggregation among multiple copies of a single type of tiles.

Second, we use different strengths of binding energy for specific edge interactions to encourage staged self-assembly of finite arrays during annealing of all types of tiles in one pot. For example, in the fully-connected 4 by 4 array design shown in Fig. S54, edge interactions between tiles within the same top-left 2 by 2 array (i.e. 1/1*, 3/3*, 4/4* and 6/6*) were designed with a stronger binding energy (11 edge staples each have a 1 nt sticky end and a stacking bond, resulting in 33 stacking bonds total); edge interactions between tiles in adjacent rotated 2 by 2 arrays (i.e. 2/2* and 5/5*) were designed with a weaker binding energy (4 edge staples each have a 2 nt sticky end and a stacking bond, resulting in 16 stacking bonds total). With this edge design, when the four types of tiles were mixed together and slowly cooled down from 50 to 20 °C at 2 min/0.1°C, we expect that one copy of each tile type will first cooperatively self-assemble into a 2 by 2 array, and then four copies of the same 2 by 2 arrays will self-assemble into a 4 by 4 array. We believe this design strategy promotes high yield of finite arrays because it divides a more complex self-assembly process into multiple simpler stages and reduces the potential spurious interactions that could occur at any given time.

Third, we balance the tile orientations as much as possible in all 2 by 2 neighborhoods. For example, an ideal 2 by 2 neighborhood would have each tile in a different 90° rotation, as used to balance out the curvature of individual tiles in the unbounded array design shown in Fig. S18.

Lastly, we use as few edge codes as possible. Each edge code corresponds to a specific set of edge staples with a specific length of sticky end on the 5' and 3' end of each staple (a stacking bond can be seen as a 0-length sticky end). Thanks to the sequence variation at different locations of the M13 scaffold, the sticky end sequences complementary to the scaffold on all four sides of the square DNA origami tile are naturally different. Thus, each edge code can provide a maximum of four pairs of distinct edge interactions, and m distinct edges would require a minimum of $\lceil m/4 \rceil$ codes.

The goals of having ideal tile orientations and minimum number of edge codes constrain each other and typically cannot be achieved simultaneously. For example, if the top left quarter of the 4 by 4 array shown in Fig. S54a were to follow the same orientations of the 2 by 2 neighborhood shown in Fig. S18, edge interactions 1/1* and 4/4* (similarly 3/3* and 6/6*) would have to use the same edges and thus cannot be implemented with one edge code. In this case, we decided to use two instead of four tile orientations that are 90° rotated from each other in the top left quarter, which allowed one edge code to be applied to these four edge interactions (Fig. S54bc).

Note that the sticky end sequences are decided by the receiving edges, and a giving edge can be complementary to any receiving edge regardless of the orientation of a tile. Thus when we try to identify the orientation of each tile following the last two design criteria, we can first focus on the tiles with receiving edges, and the orientation of each tile with only giving edges can then be decided solely based on the maximum balance of tile curvature.

What we are not taking into consideration here is that different choices of tile orientations simultaneously result in different sticky end and stacking bond sequences associated with the edge interactions, which could also affect the yield of designed finite arrays. It is possible to have a fifth design criterion regarding specific sequence choices, but in that case the last three criteria would all constrain each other and limit the design space of edge interactions.

Though we have not yet explored, it is possible to utilize the extended edge design shown in Fig. S31 and make it a more general approach for increasing the design space of edge interactions, which could potentially be used in creating a large set of distinct edges for finite arrays. It should also be possible to further reduce spurious interactions and allow more sophisticated finite self-assembly through designs that ensure each stage of the self-assembly to actually take place sequentially. For example, with a properly designed activation mechanism, DNA strands that can activate specific edge interactions[15] involved in a next stage could be added after the previous stage of self-assembly has completed. Alternatively, with an appropriate edge design, tiles with edge interactions involved in different stages could be prepared in different test tubes and then mixed together in sequential steps.[16] With an increased number of distinct edges, uniquely addressable finite arrays could also be created.

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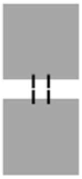
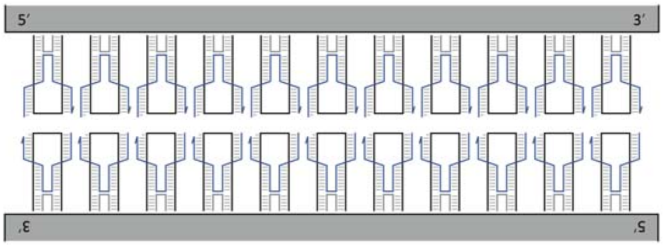
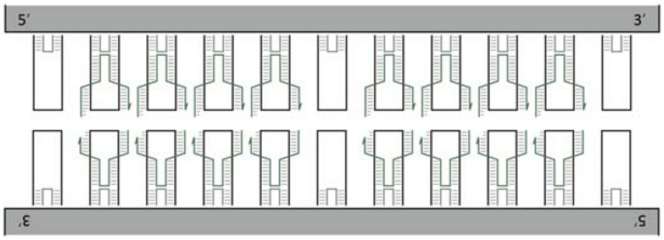
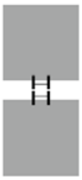
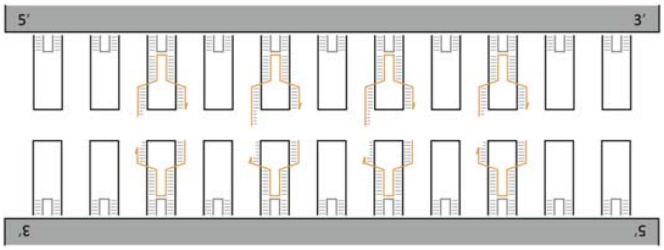
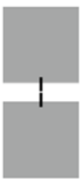
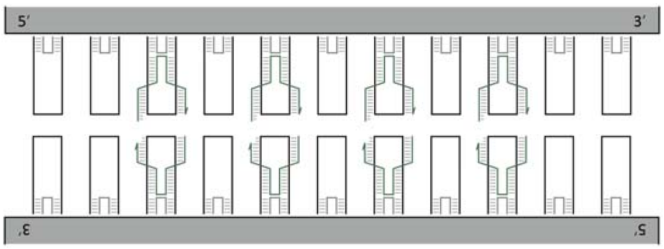
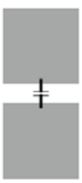
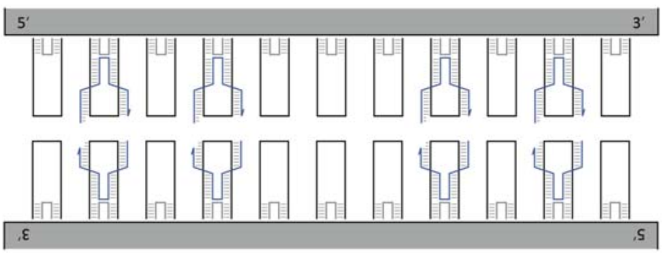
Code #	Abstraction	Edge design	Total stacking bonds
1			33
2			32
3			22
4			16
5			16

Figure S52: **Five types of edge codes used in finite arrays with designed size.** Each edge code corresponds to a specific set of edge staples with a specific length of sticky end on the 5' and 3' end of each staple (a stacking bond can be seen as a 0-length sticky end). Thanks to the sequence variation at different locations of the M13 scaffold, the sticky end sequences complementary to the scaffold on all four sides of the square DNA origami tile are naturally different. Thus, each edge code can provide a maximum of four pairs of distinct edge interactions. The total stacking bonds is calculated as the sum of stacking bonds provided by all edge staples (a 1-nt sticky end adds two stacking bonds, a 2-nt sticky end adds three stacking bonds, etc.). Total stacking bonds is an indication of the binding energy between two edges of tiles, but the actual binding energy also depends on sequences and geometry.

S8.3 Finite arrays of the fully connected design

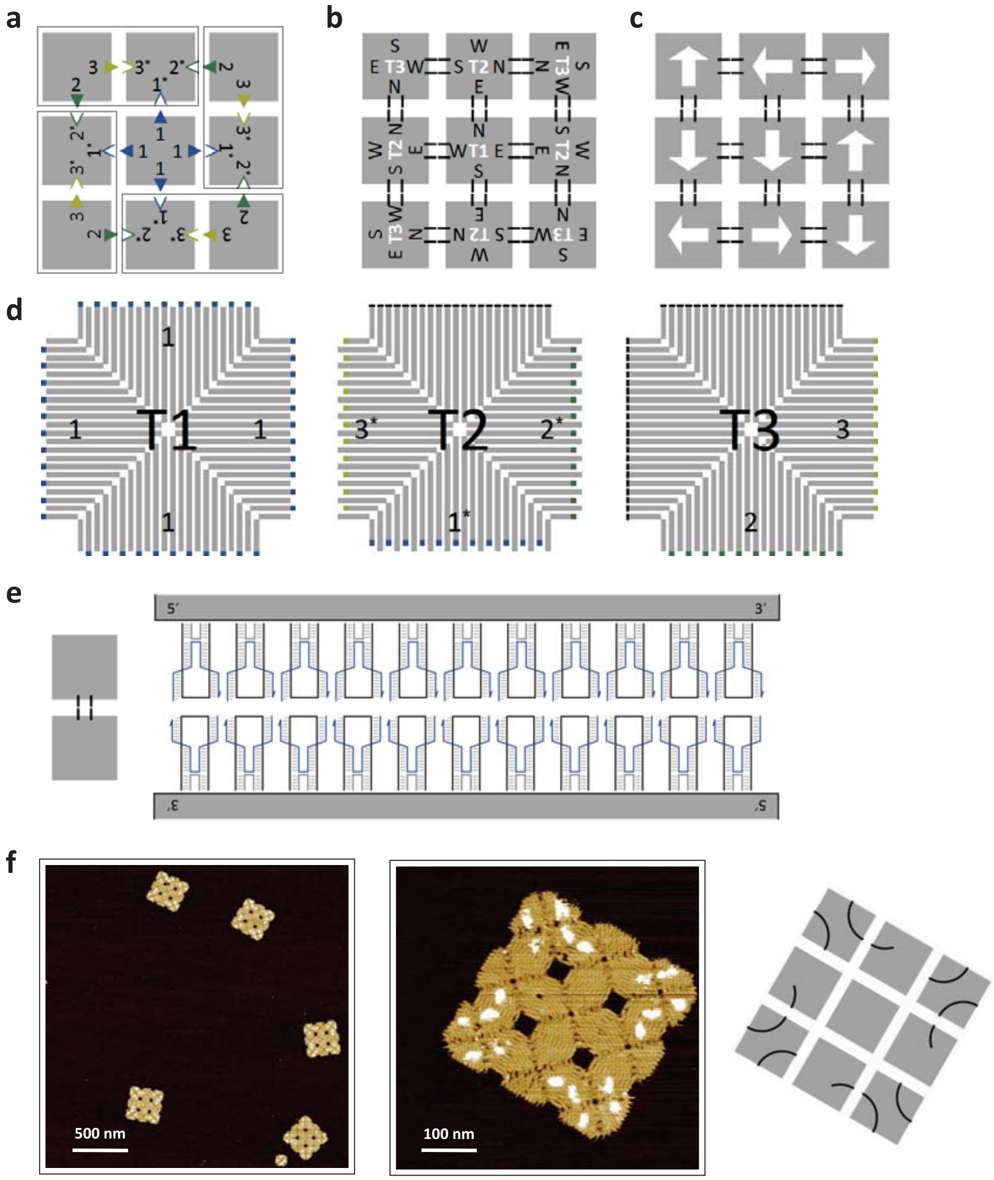


Figure S53: **Fully connected 3 by 3 arrays of square DNA origami tiles. a,** Abstract design diagram with three pairs of distinct edge interactions labeled as 1/1* to 3/3*. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. **b,** Abstract design diagram with three distinct types of tiles labeled as T1 to T3, four sides of each tile labeled as N, E, S and W, and the only type of edge code indicated as two bars between the tiles. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the three distinct types of tiles. **e,** Edge design. **f,** AFM images. The left is an example image of multiple 3 by 3 arrays. The right is a representative image of a single 3 by 3 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Tile 1 was not labeled, tile 2 was labeled with a half arc, and tile 3 was labeled with two arcs. Sequences of staple strands are listed in Tables S2, and S12 to S14.

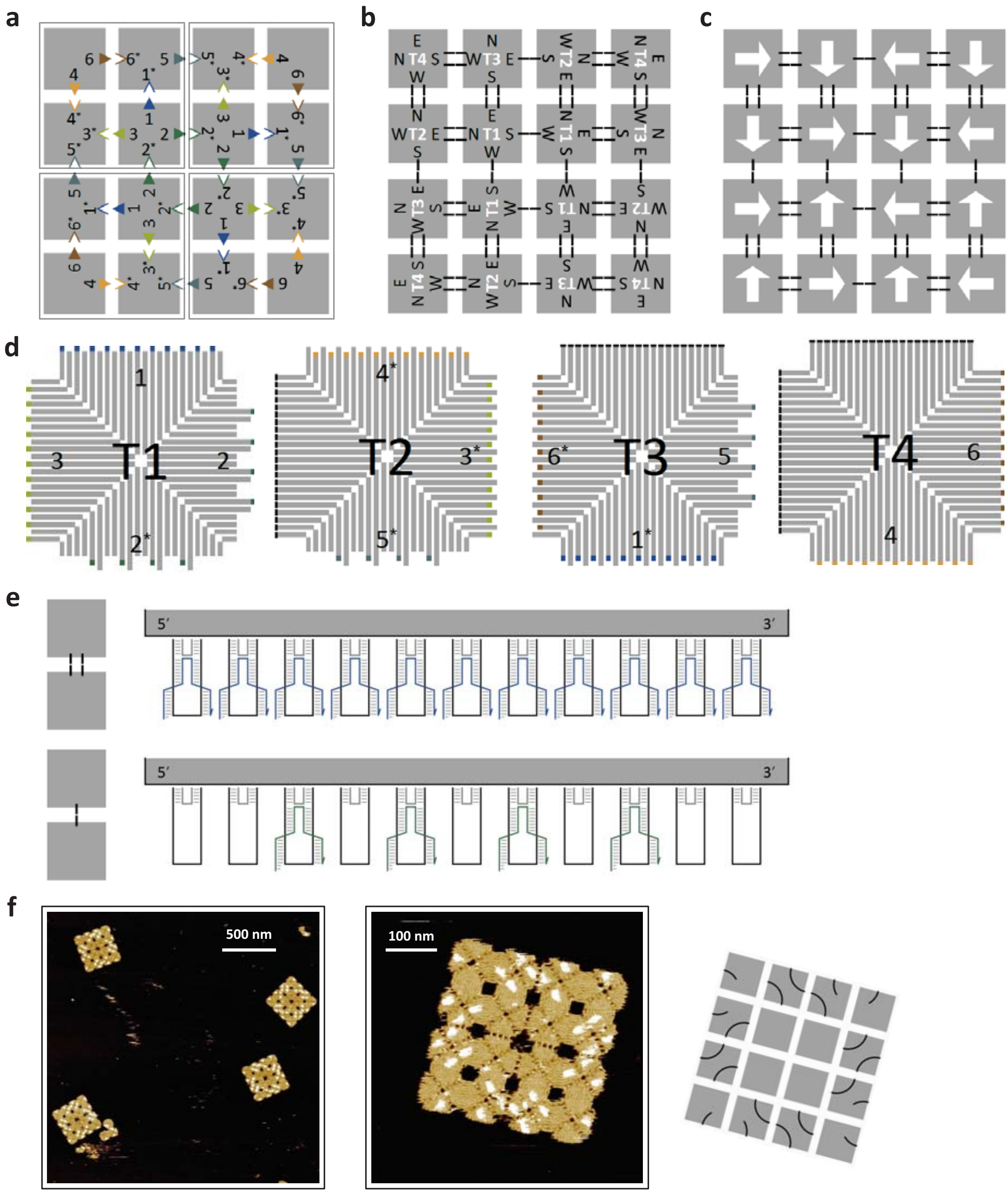


Figure S54: **Fully connected 4 by 4 arrays of square DNA origami tiles. a,** Abstract design diagram with six pairs of distinct edge interactions labeled as 1/1* to 6/6*. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. **b,** Abstract design diagram with four distinct types of tiles labeled as T1 to T4, four sides of each tile labeled as N, E, S and W, and two types of edge codes indicated as one and two bars between the tiles. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the four tiles. **e,** Edge design of the two codes. **f,** AFM images. The left is an example image of multiple 4 by 4 arrays. The right is a representative image of a single 4 by 4 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Sequences of staple strands are listed in Tables S2, and S15 to S18.

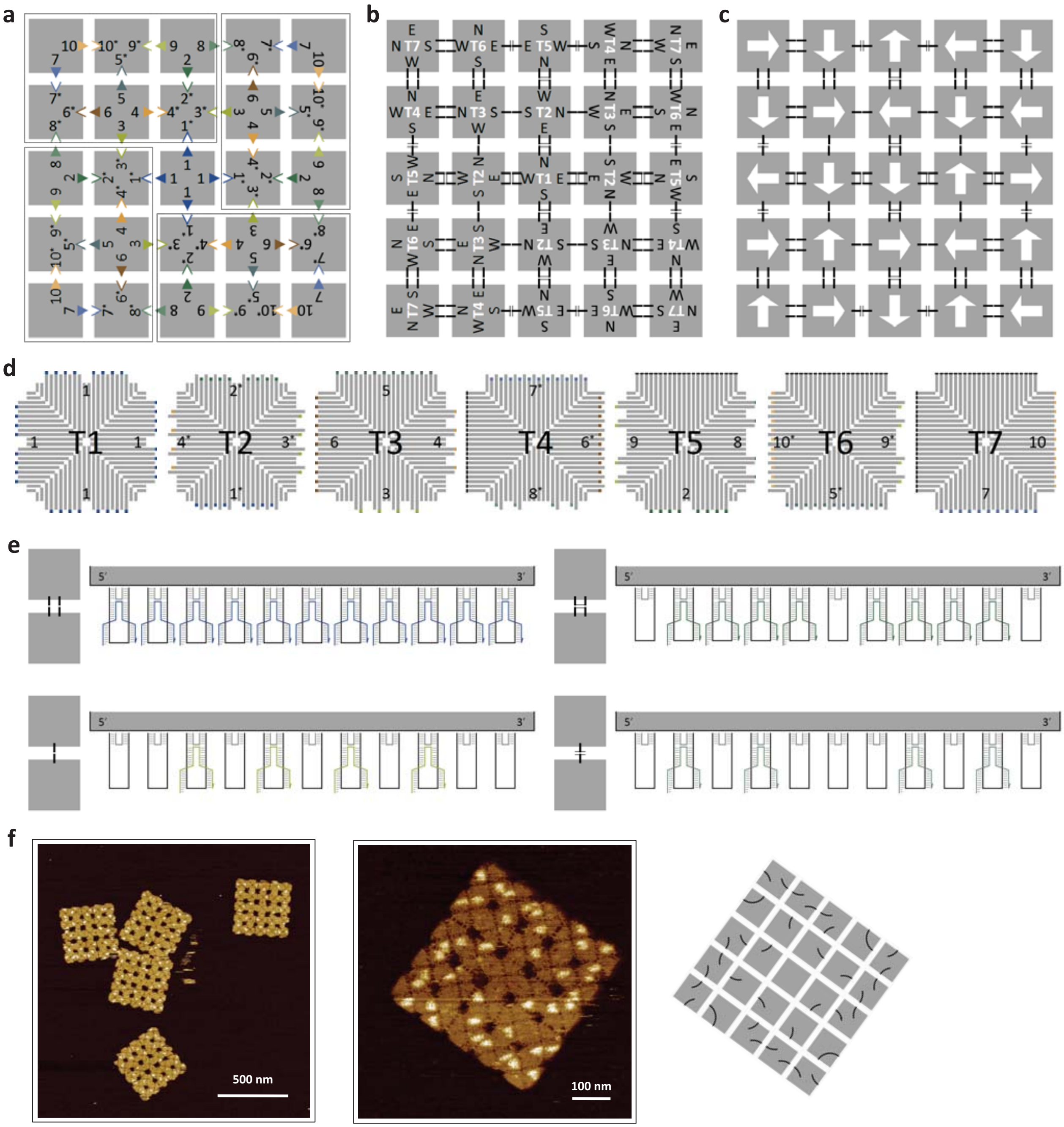


Figure S55: **Fully connected 5 by 5 arrays of square DNA origami tiles. a,** Abstract design diagram with ten pairs of distinct edge interactions labeled as 1/1* to 10/10*. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. **b,** Abstract design diagram with seven distinct types of tiles labeled as T1 to T7, and four sides of each tile labeled as N, E, S and W. Four types of edge codes are indicated as one or two bars between the tiles, with or without lines in the middle. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the seven tiles. **e,** Edge design of the four codes. **f,** AFM images. The left is an example image of multiple 5 by 5 arrays. The right is a representative image of a single 5 by 5 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Sequences of staple strands are listed in Tables S2, and S19 to S25.

S8.4 Finite arrays of the comb design

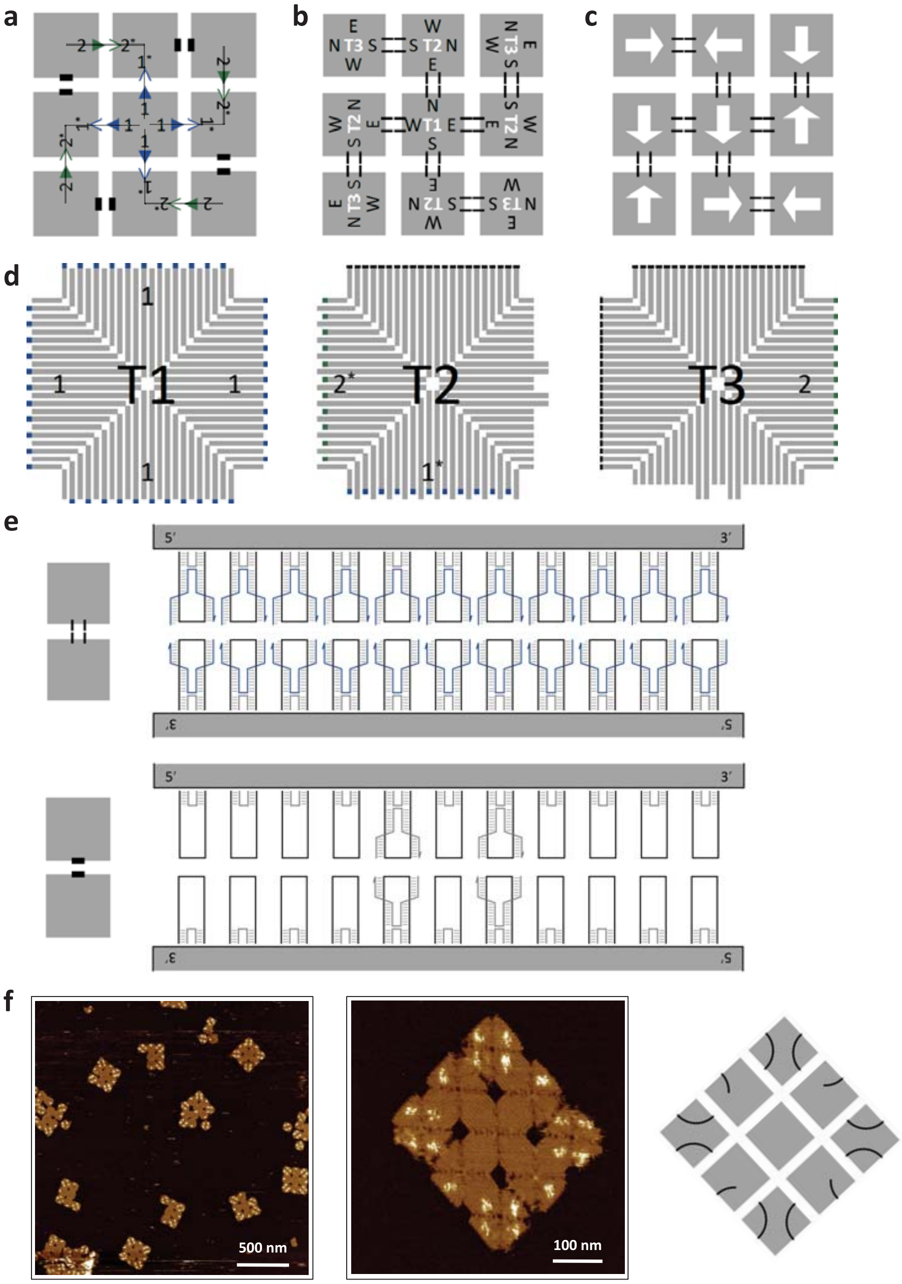


Figure S56: **Comb connected 3 by 3 arrays of square DNA origami tiles. a,** Abstract design diagram with two pairs of distinct edge interactions labeled as 1/1* and 2/2*. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. Black bars indicate weak stabilizing edge interactions including just two staples that each provide two stacking bonds. **b,** Abstract design diagram with three distinct types of tiles labeled as T1 to T3, four sides of each tile labeled as N, E, S and W, and the only type of edge code indicated as two bars between the tiles. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the three distinct types of tiles. **e,** Edge design. **f,** AFM images. The left is an example image of multiple 3 by 3 arrays. The right is a representative image of a single 3 by 3 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Sequences of staple strands are listed in Tables S2, and S26 to S28.

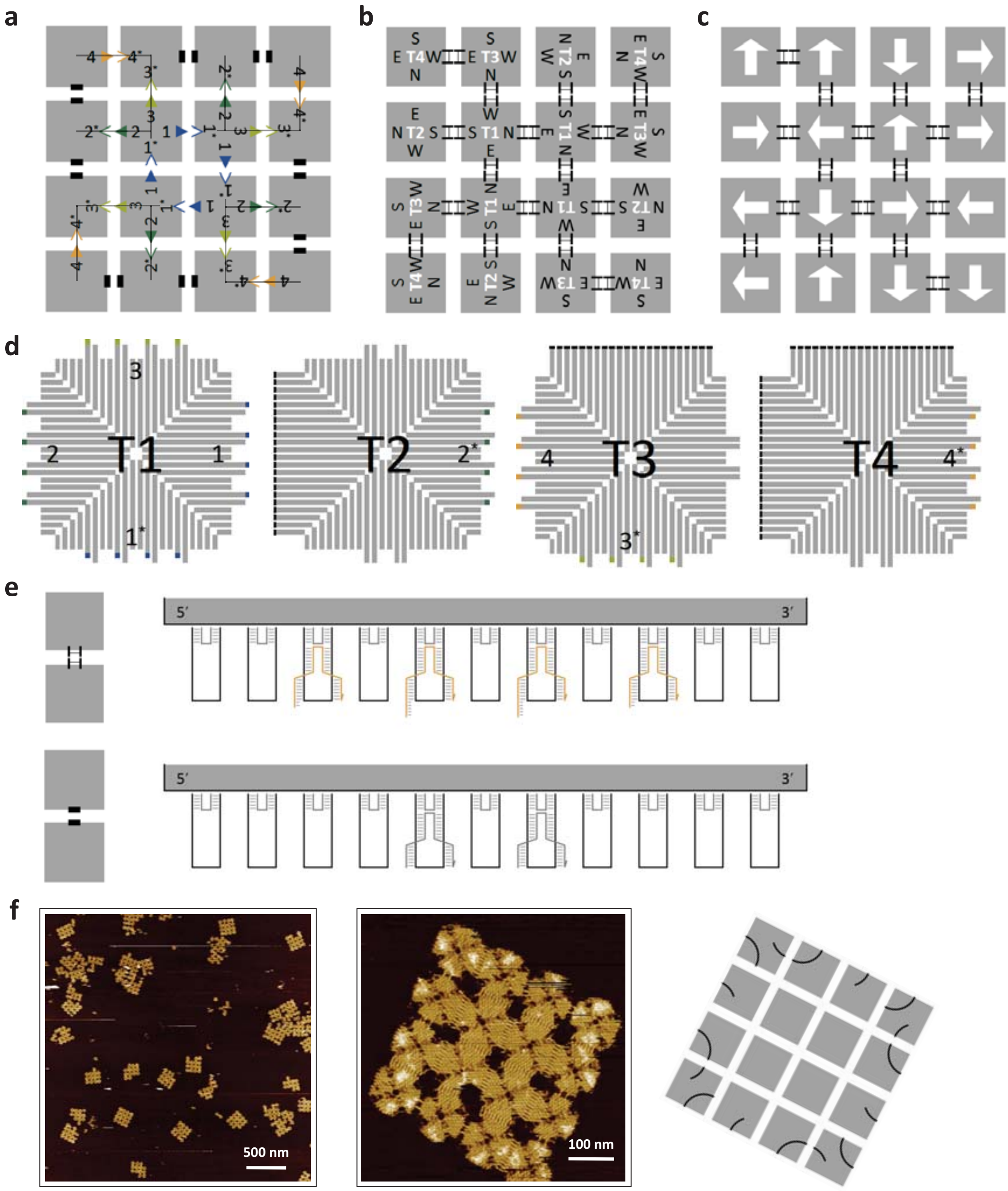


Figure S57: **Comb connected 4 by 4 arrays of square DNA origami tiles. a,** Abstract design diagram with four pairs of distinct edge interactions labeled as 1/1* to 4/4*. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. Black bars indicate weak stabilizing edge interactions including just two staples that each provide two stacking bonds. **b,** Abstract design diagram with four distinct types of tiles labeled as T1 to T4, and four sides of each tile labeled as N, E, S and W. The only type of edge code is indicated as two bars between the tiles, with lines in the middle. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the four tiles. **e,** Edge design. **f,** AFM images. The left is an example image of multiple 4 by 4 arrays. The right is a representative image of a single 4 by 4 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Sequences of staple strands are listed in Tables S2, and S29 to S32.

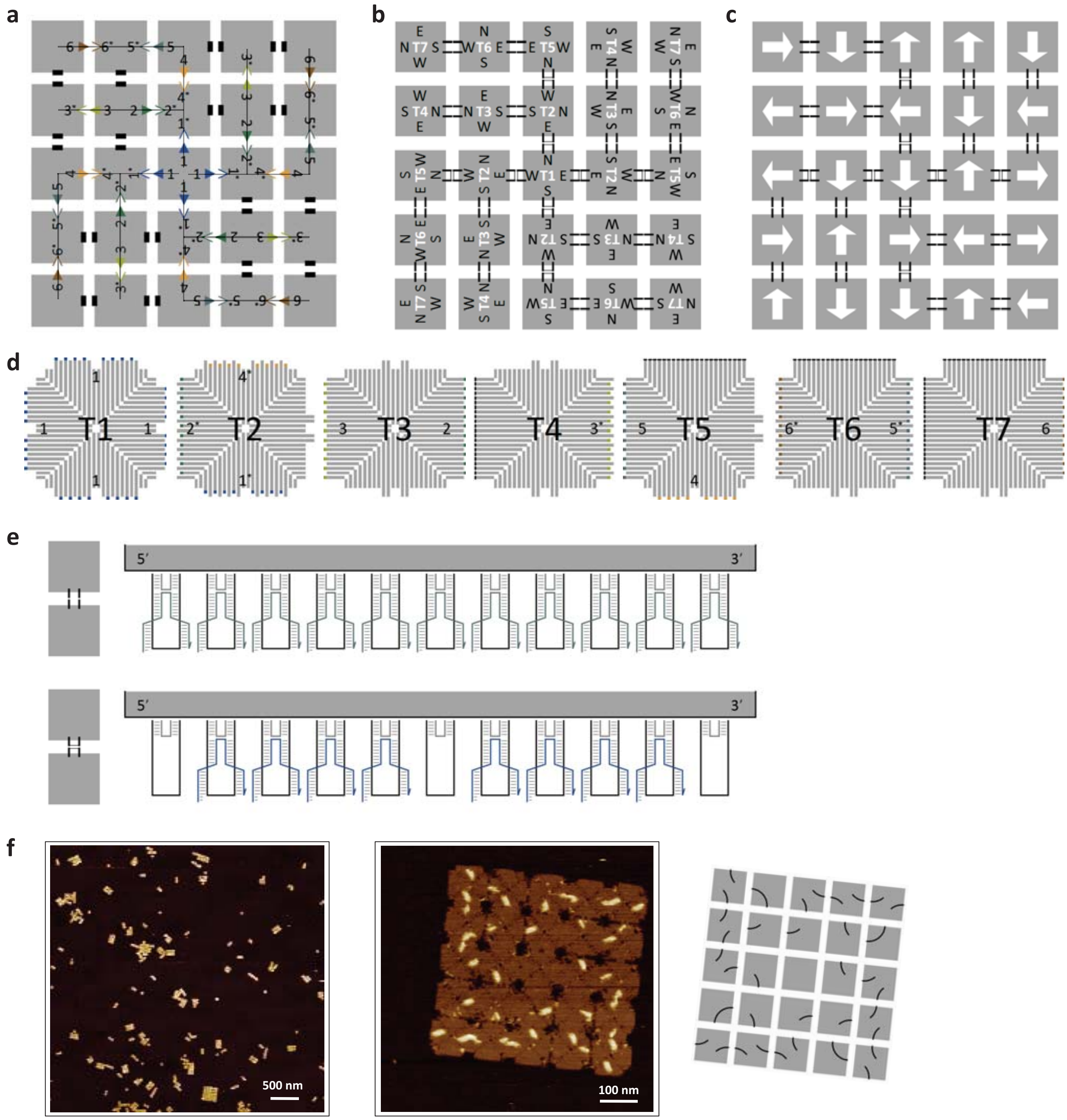


Figure S58: **Comb connected 5 by 5 arrays of square DNA origami tiles. a,** Abstract design diagram with six pairs of distinct edge interactions labeled as 1/1⋆ to 6/6⋆. Giving edges and receiving edges are indicated by solid triangles facing outward and hollow triangles facing inward, respectively. Black bars indicate weak stabilizing edge interactions including just two staples that each provide two stacking bonds. **b,** Abstract design diagram with seven distinct types of tiles labeled as T1 to T7, and four sides of each tile labeled as N, E, S and W. Two types of edge codes are indicated as two bars between the tiles, with or without lines in the middle. **c,** Abstract design diagram with the orientation of each tile indicated by an arrow pointing from side N to side S. **d,** Tile abstraction of the seven tiles. **e,** Edge design. **f,** AFM images. The left is an example image of multiple 5 by 5 arrays. The right is a representative image of a single 5 by 5 array, showing that all tiles are in the designed locations and all edge interactions have the designed number of bonds. Sequences of staple strands are listed in Tables S2, and S33 to S39.

S8.5 Yield calculation

When estimating the efficiency of origami monomers self-assembling into finite arrays with designed size, the calculation could easily be an overestimate of the actual yield if there is no rigorous method applied to avoid the bias in obtaining AFM images. For example, if we calculate the yield based on a couple of selected AFM images of approximately 2 by 2 μm in size, similar to how the yield was calculated in previous approaches for creating finite origami arrays,[17,18] the yield of the fully-connected 3 by 3, 4 by 4 and 5 by 5 arrays was 98%, 95% and 99%, respectively (Figs. S53, S54 and S55). However, to estimate the yield with higher accuracy and statistical significance, we collected high-resolution (2160 $\times$ 2160 pixels) AFM images of 30 by 30 μm in size, and developed a software tool to assist the yield calculation of origami structures. In our method, the yield of finite arrays was determined as the total pixels in isolated complete assemblies of the designed size in an AFM image divided by the total pixels above the threshold of background. With AFM images that each have 3,000 to 12,000 origami tiles, the yield of the same fully-connected 3 by 3, 4 by 4 and 5 by 5 arrays shown in Figs. S53, S54 and S55 was reliably calculated to be 15.6%, 15.0% and 32.4%, respectively (Figs. S60, S61 and S62).

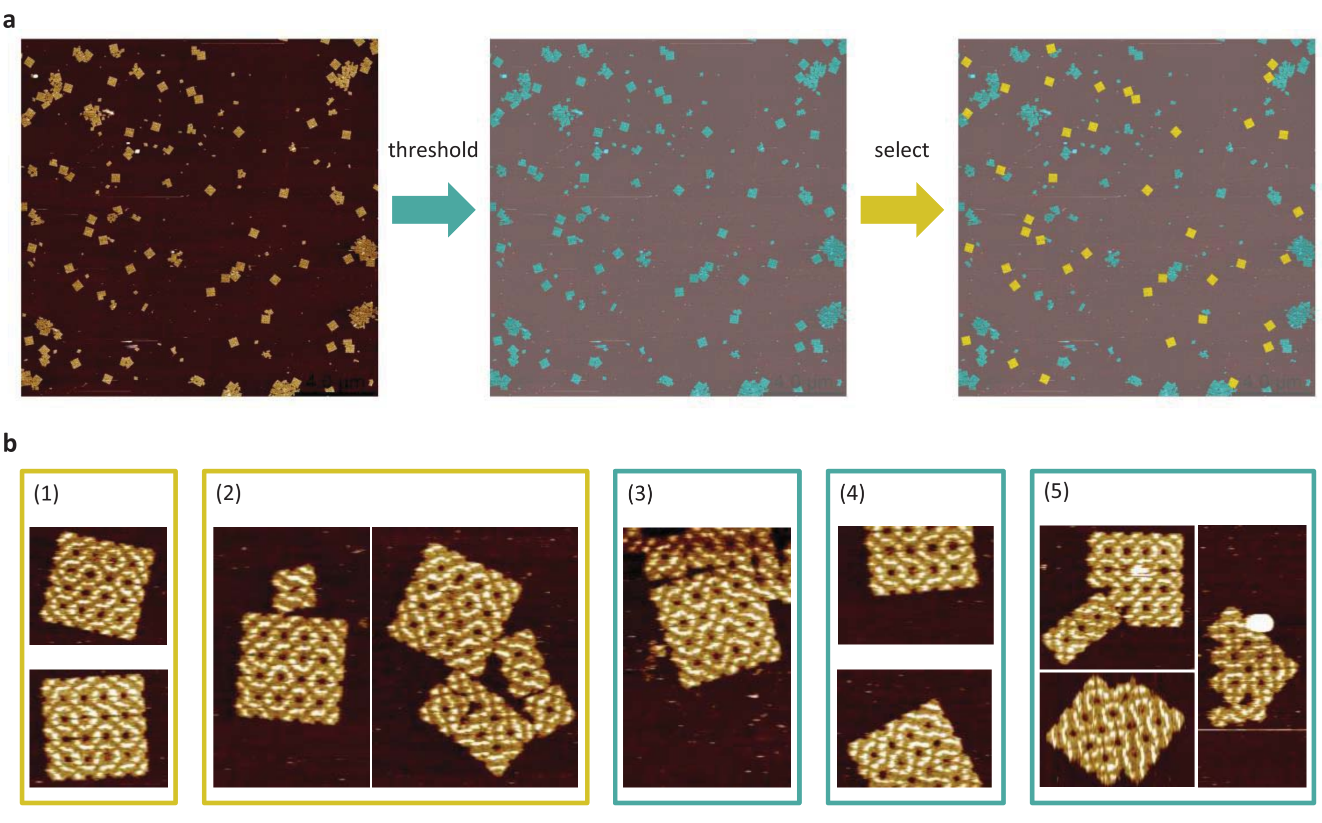


Figure S59: **Calculating the yield of finite origami arrays. a,** Example yield calculation for 5 by 5 finite arrays. A large AFM field of view was taken as a representative sample of array distribution. A threshold was applied to the image and divide the image into background mica and DNA objects. A simple program was written for manually selecting arrays of sufficient quality to calculate yield = yellow pixels/(yellow+blue pixels) where yellow is array types (1) and (2) shown in (b) and blue is all other types above the threshold of background. With this method, the yield of 5 by 5 arrays from this 20 by 20 μm AFM image was calculated to be 30.6%. **b,** The arrays are differentiated by their "quality": (1) on target and isolated, (2) on target with low edge contact, (3) on target with high edge contact, (4) straddling the field of view, and (5) off target. Yellow boxes around (1) and (2) indicate "good quality" structures that were selected; blue boxes around (3), (4) and (5) indicate "bad quality" structures that were not selected.

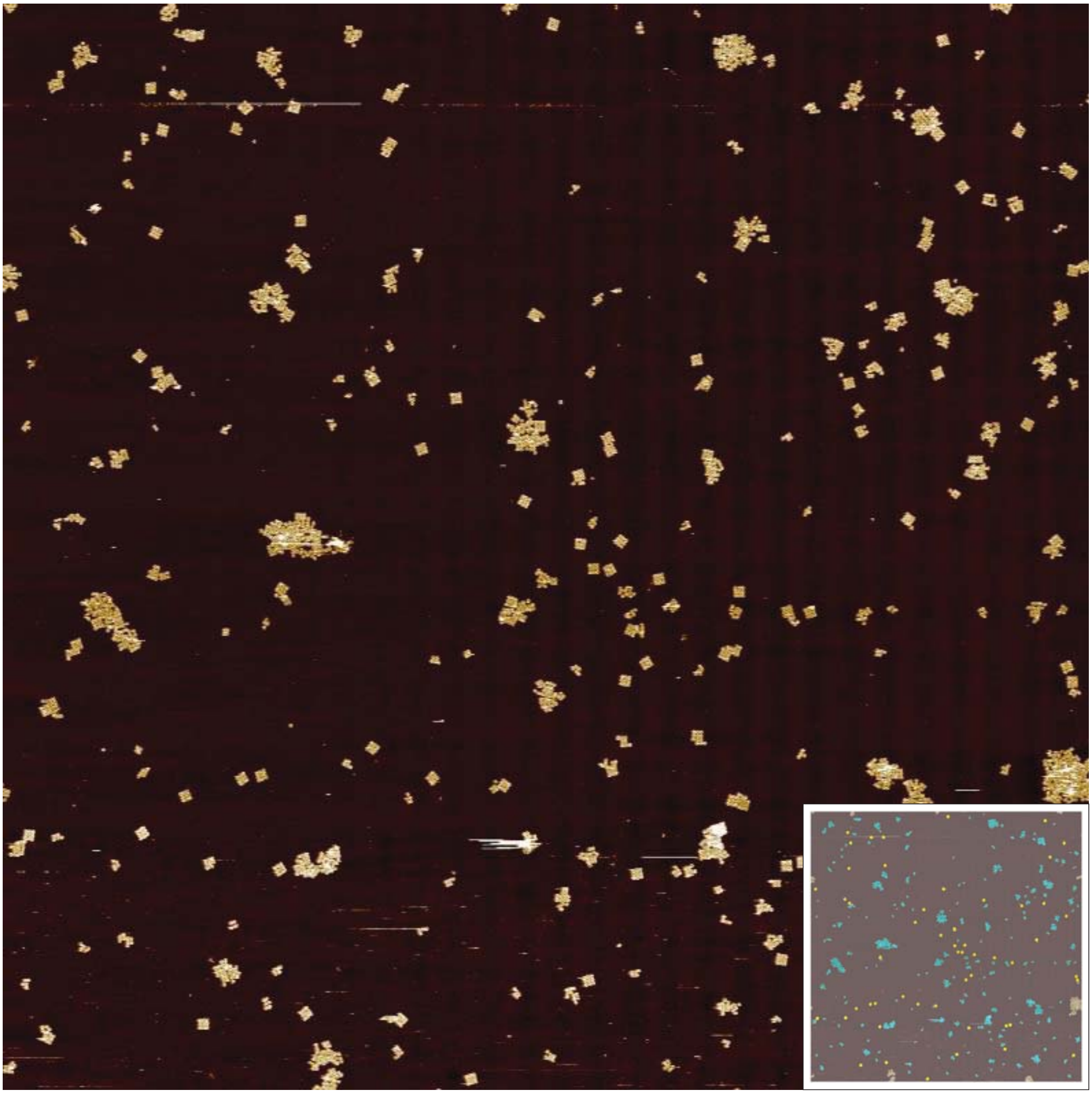


Figure S60: **A 30 by 30 μm AFM image of the fully connected 3 by 3 arrays, from which the yield was calculated to be 15.6%.**

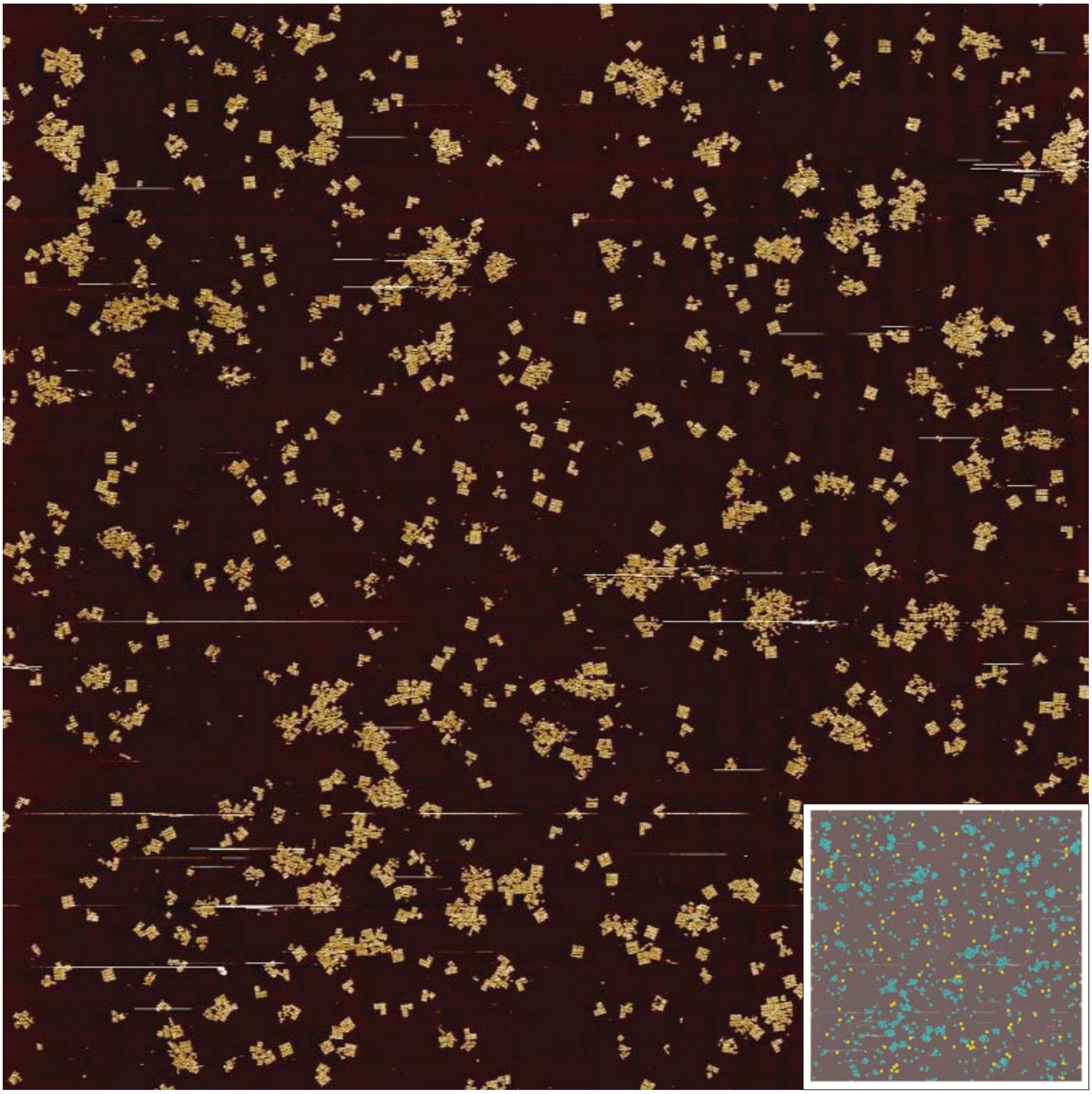


Figure S61: **A 30 by 30 μm AFM image of the fully connected 4 by 4 arrays, from which the yield was calculated to be 15.0%.**

DOI: 10.1038/NNANO.2016.256

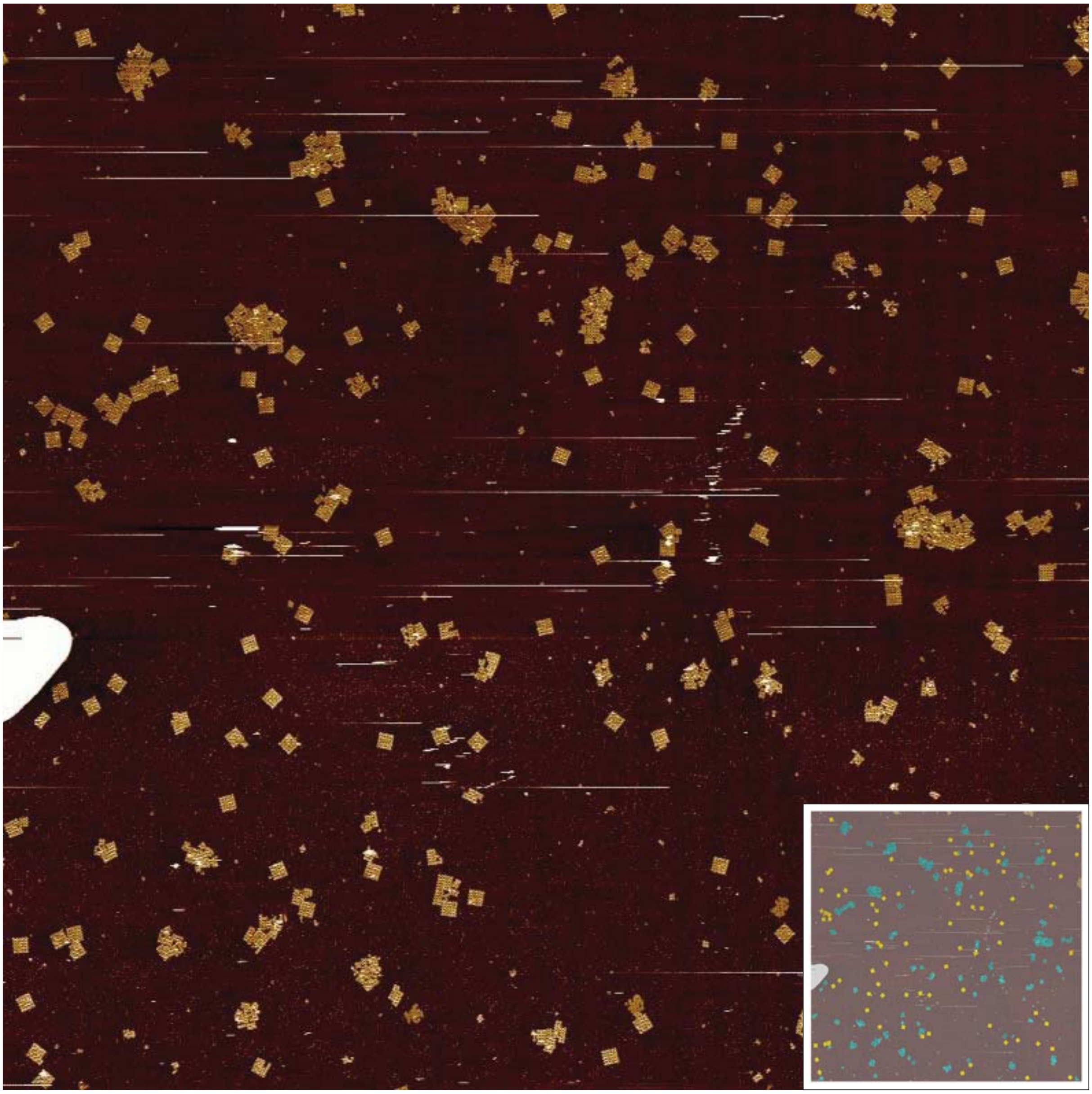


Figure S62: **A 30 by 30 μm AFM image of the fully connected 5 by 5 arrays, from which the yield was calculated to be 32.4%.**

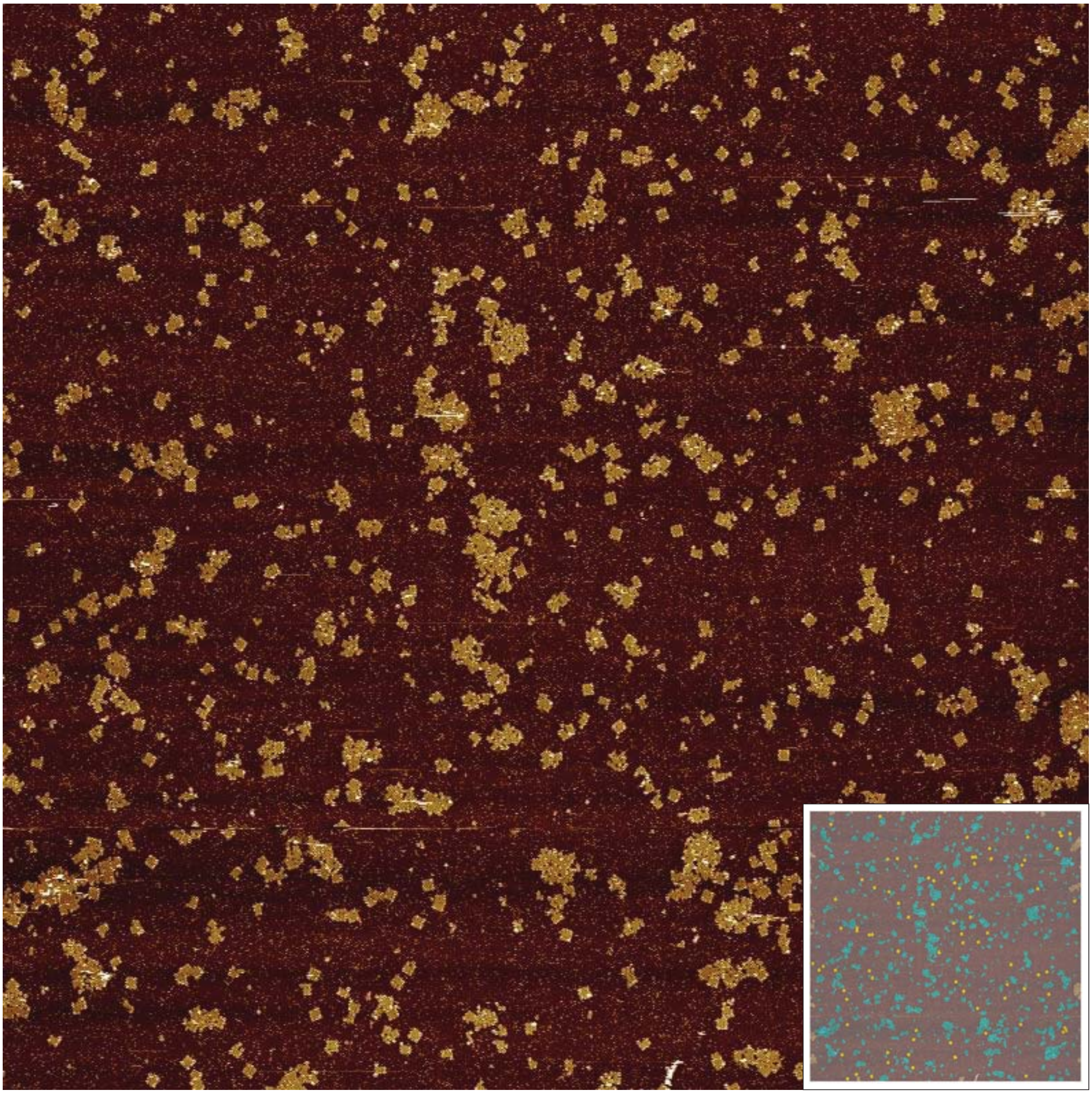


Figure S63: **A 30 by 30 μm AFM image of the comb connected 3 by 3 arrays, from which the yield was calculated to be 8.0%.**

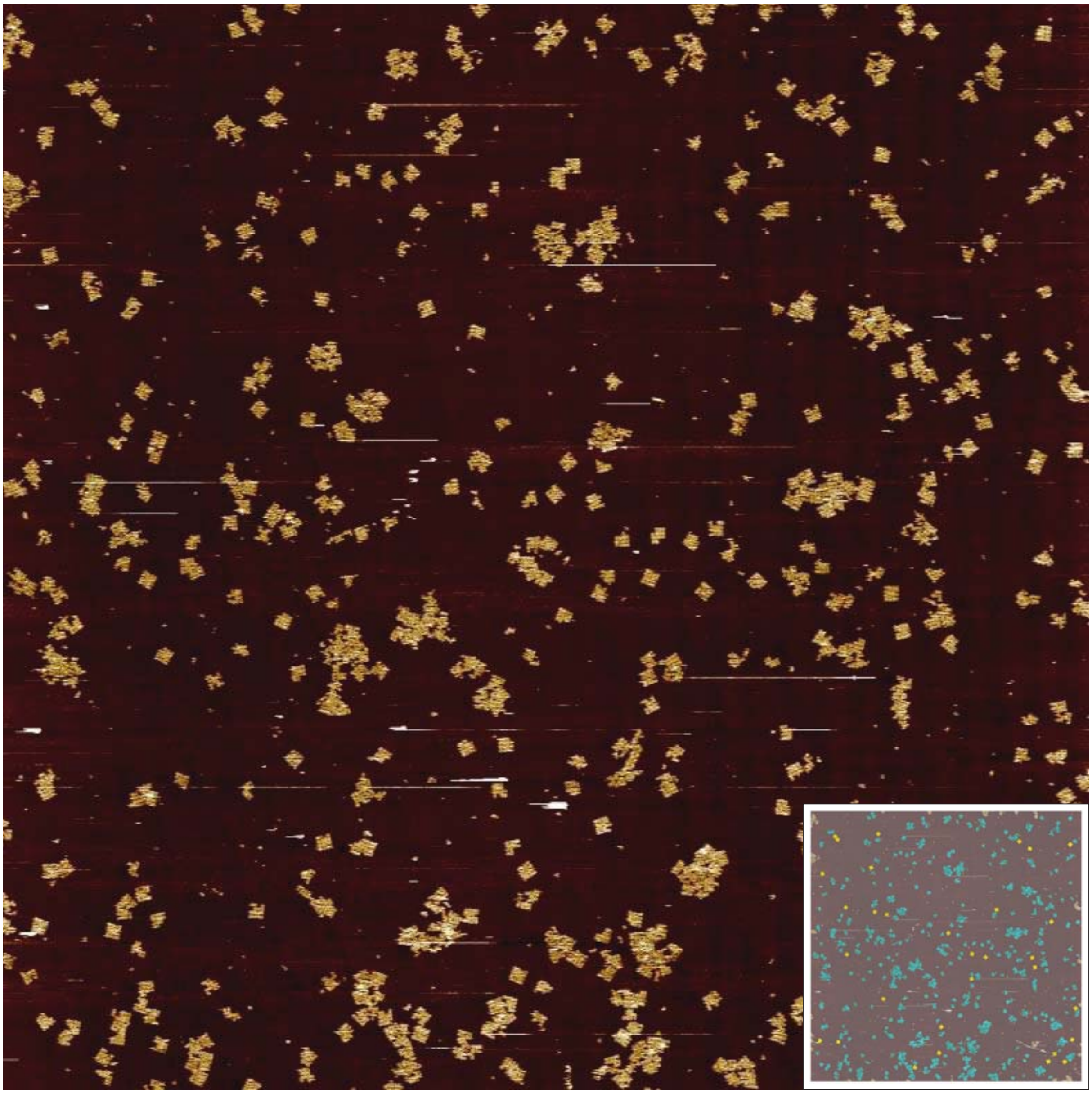


Figure S64: **A 30 by 30 μm AFM image of the comb connected 4 by 4 arrays, from which the yield was calculated to be 6.7%.**

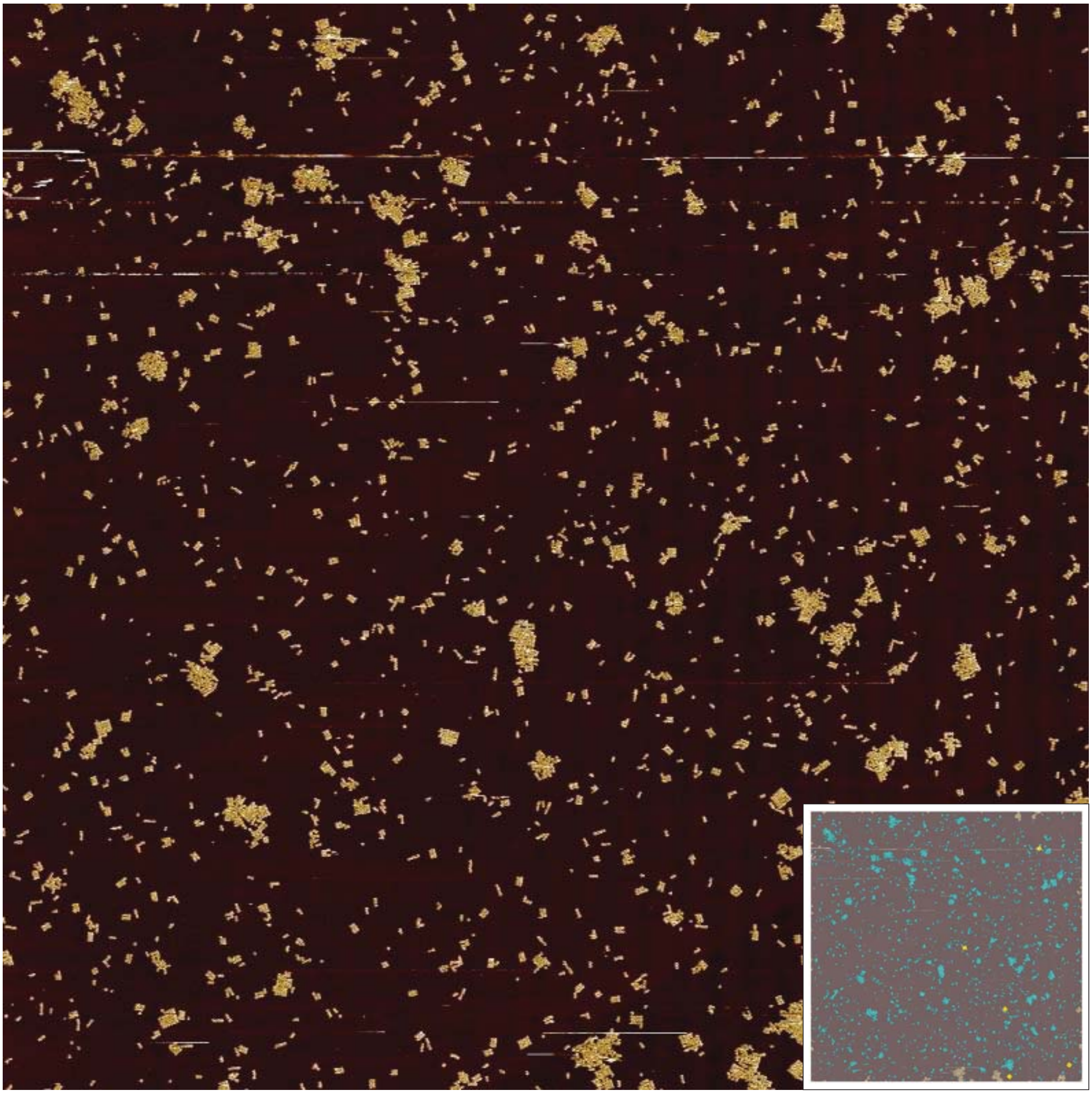


Figure S65: **A 30 by 30 μm AFM image of the comb connected 5 by 5 arrays, from which the yield was calculated to be 1.3%.**

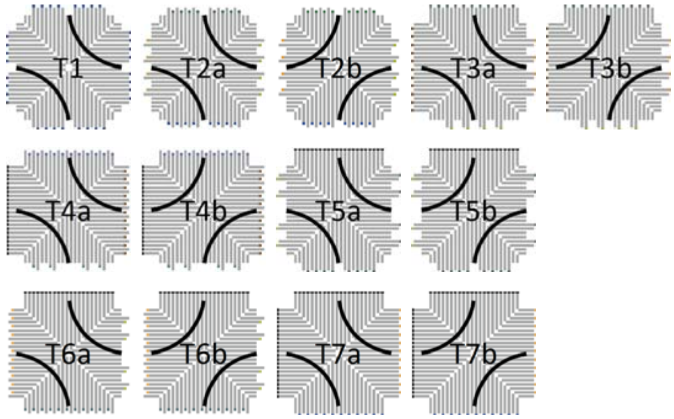
DOI: 10.1038/NNANO.2016.256

S8.6 Random loops and mazes on a finite grid

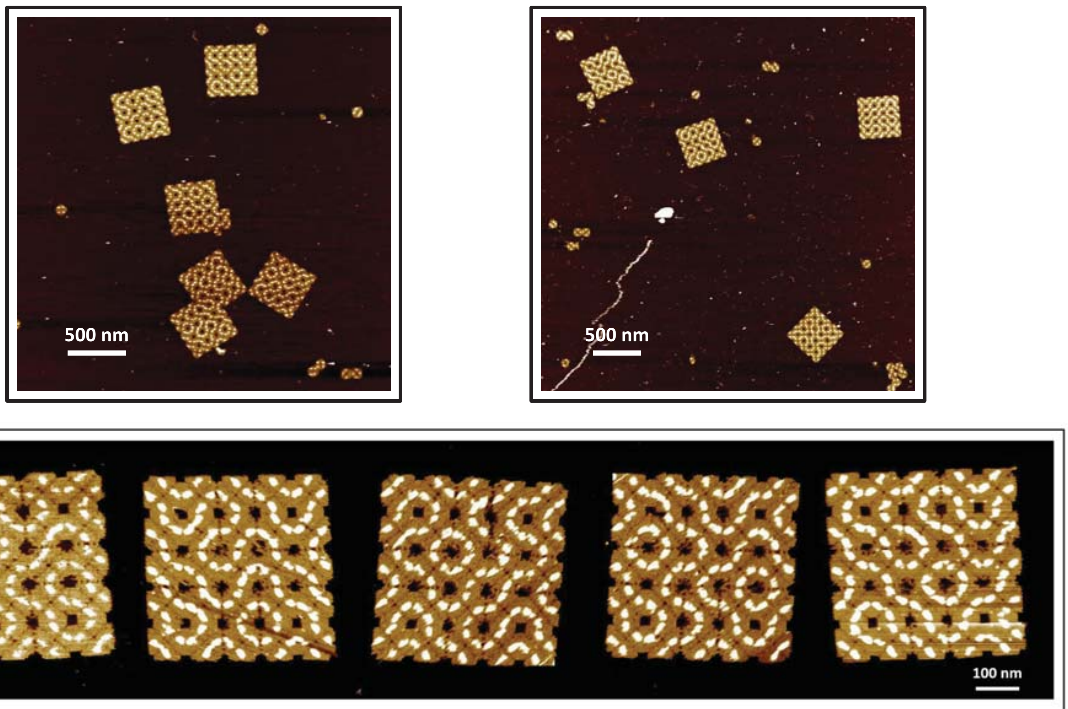
The rule for defining a grid with multiple types of tiles is $grid[(i, j),\ tile[1, 2, \ldots]] = [\text{If } cond_1(i, j),\ tile[set_1] @ orient_1; \ldots]$. (i, j) indicates a location on the grid. $cond_i$ defines a set of specific locations on the grid, as a function of (i, j). $cond_i$ can be associated with $tile[set_i]$, which is a subset of all possible types of tiles. $orient_i$ defines the orientation of a tile at $cond_i$ on the grid.

a

```
Grid5by5[(i, j), tile[1 to 7]]=[
   If i==3 and j==3, tile[1] @ 0 degree;
   If 1<=i<3 and j<=3, tile[3*(2-i)+5-j] @ 0 degree;
   If 3<=i<=5 and j<3, tile[3*(2-j)+i-1] @ 90 degree;
   If 3<i<=5 and j>=3, tile[3*(i-4)+j-1] @ 180 degree;
   If i<=3 and 3<j<=5, tile[3*(j-4)+5-i] @ 270 degree];
tile[1 to 7] = arc_tile @ RandomChoice[(0, 90) degree];
arc_array5by5 = tile[1 to 7] @ Grid5by5
```



b



c

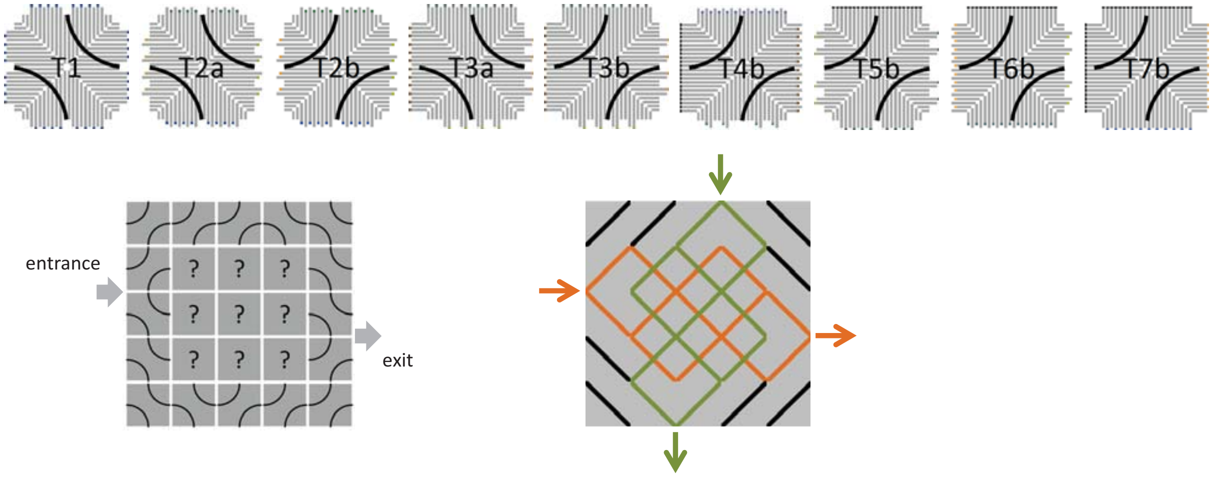
Average number of circles (theory): $\mu = (m-1) \times (n-1) \times \left(\frac{1}{2}\right)^4 = 1$

Average number of circles (experiments): $\mu \pm 2\sigma = 1.0 \pm 0.6$

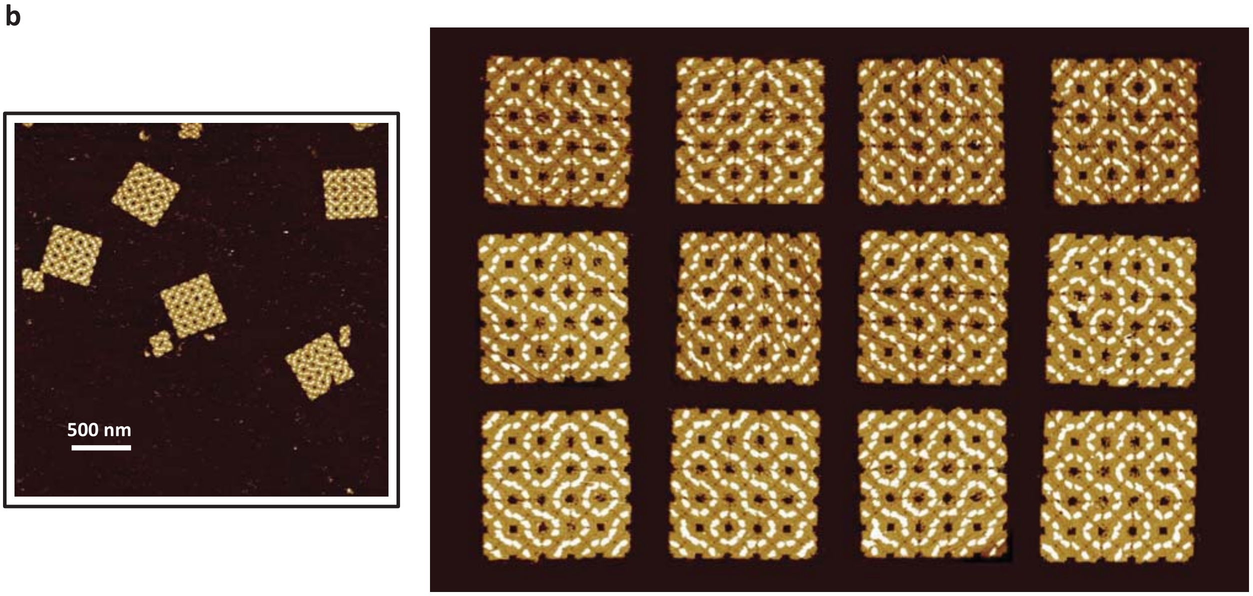
Figure S66: **Random loops and mazes on fully connected 5 by 5 arrays. a,** Design. **b,** AFM images. The bottom image of 5 distinct mazes is composed from five independent AFM images. **c,** Analysis. m and n indicate the size of the random arrays. Here, $m = 5$ and $n = 5$. μ is the average number of circles, σ is the standard error of the mean, and $\pm 2\sigma$ corresponds to 95% confidence.

a

```
tile[1, 2, 3] = arc_tile @ RandomChoice[(0, 90) degree];
tile[4, 5, 6, 7] = arc_tile @ 90 degree;
arc_array5by5 = tile[1 to 7] @ Grid5by5
```



b



c

Fraction of mazes with a path from the designed entrance to exit (theory): 100%

Fraction of mazes with a path from the designed entrance to exit (experiments): 100%

Fraction of mazes with a shortest path of length 5 (theory): $\frac{255}{256} = 99.6\%$

Fraction of mazes with a shortest path of length 5 (experiments): 100%

Figure S67: **Random mazes with designed entrance and exit. a,** Design of mazes with with fixed arc orientation of the exterior tiles and random arc orientation of the interior tiles. Taking rotational symmetry into consideration, there exist $2^8 = 256$ distinct mazes, all of which have a path from the designed entrance to exit. The right diagram shows line mazes of diagonal tiles that are equivalent to the area mazes of arc tiles. Any choice of the interior tiles that breaks the only remaining path from left to right (shown in orange) must connect a path from top to bottom (shown in green), and vise versa. **b,** AFM images. The right image of 12 distinct mazes is composed from several independent AFM images. **c,** Analysis.

S8.7 Example finite grid with a more complex shape

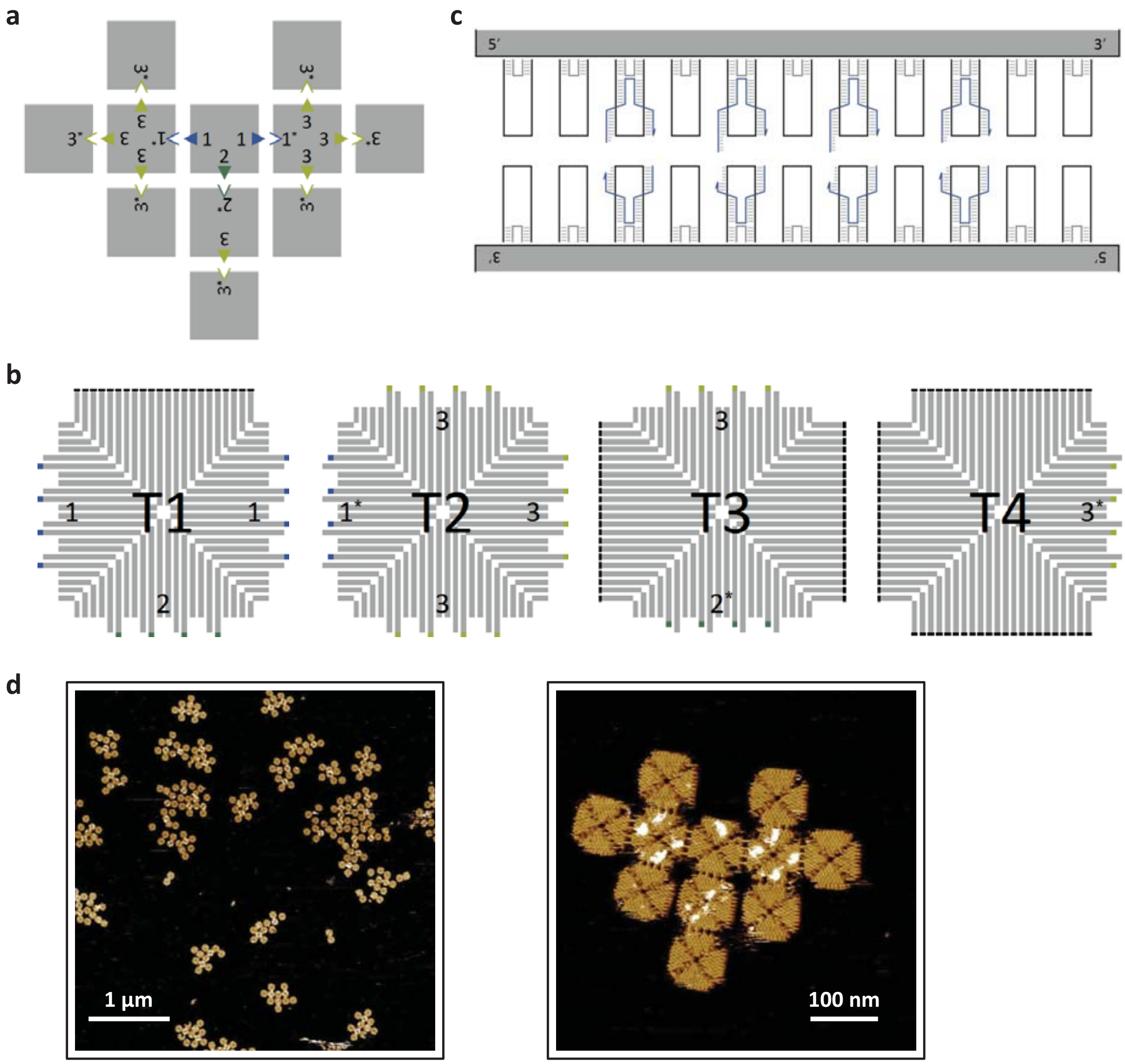


Figure S68: **A heart shape self-assembled from four types of square DNA origami tiles. a,** Array abstraction. **b,** Tile abstraction. **c,** Edge design. **d,** AFM images. Designed and created by James Parkin (graduate student of Bioengineering), Aditya Karan (undergraduate student of Computer Science), and Stella Wang (undergraduate student of Bioengineering) at Caltech.

S9 Potential applications

S9.1 Operating and testing environment for molecular robots

Protein motors such as kinesin and dynein can travel along complex networks of microtubules in cells and transport molecular cargos.[19,20] The sophisticated functions of biological motors have inspired the development of synthetic DNA motors. The first generation of DNA robots were developed to make a few steps on one-dimensional tracks consisting of a double helix.[21–23] After DNA origami was invented, it was used as a two-dimensional playground for DNA robots with more interesting functions, including following a path,[24] picking up cargos in an assembly line,[25] and making choices at multiple junctions.[26] The complexity of playgrounds for DNA robots not only affects the functions that can be demonstrated, but also determines how we can evaluate the designed behaviors. However, compared to the operating environments of kinesin and dynein motors, tracks that can be built on a single DNA origami are far less complex.

The random arrays that we created could be used to provide DNA robots with diverse operating and testing environments that are much more complex than a single DNA origami. This would be critical for enabling the development of DNA robots that perform increasingly sophisticated tasks such as maze-solving, and for improving our understanding of how to build robust DNA robots that operate well under a wide range of conditions. For example, loops can be used to test the persistence of robots, trees can be used to test how robots make choices at each junction without getting stuck, and mazes can be used to test if robots can find direct paths from an entrance to an exit and efficiently transport molecular cargos.

Compared to deterministic approaches, random arrays have the distinct advantage of performing massively parallel experiments in one test tube. The behaviors of molecular robots traveling on a large variety of tracks could be simultaneously recorded and analyzed, using single molecule fluorescence microscopy techniques such as DNA-PAINT.[27,28]

S9.2 Example design of combinatorial circuits

We have shown that random DNA origami arrays can be used to create combinatorial patterns with desired geometries, but in general, the principle of programmable disorder could be more broadly applied to design combinatorial circuits, devices and networks of any functional components on individual tiles, with an understanding of how to design the components that connect within a tile and among neighboring tiles, how a grid helps defining the properties of the networks, and how the probabilities of a random choice can be used to quantitatively control desired features of the networks.

For example, one can design the following combinatorial circuits with desired functions. Fig. S69ab shows a design for assembling random feedforward logic circuits with 4 inputs and 4 outputs. y_1 is a function of x_1 and x_4, y_2 is a function of x_1 and x_2, y_3 is a function of all four inputs, and y_4 is a function of just x_4. The design uses an array of 16 tiles, some of which have a fixed configuration of wires while others allow a random choice of two possible configurations such as an AND gate or a OR gate. It would allow over 2,000 distinct feedforward logic circuits to be created in one test tube. A more general example is to create random programmable logic arrays as shown in Fig. S69cd. In principle, this design can be used to implement arbitrary logic functions in the sum-of-product form.

Unlike many random combinatorial approaches in chemistry and material science that typically yield a large fraction of non-functional molecules among the functional ones, the principle of programmable disorder would enable the construction of large variations of molecular circuits, devices and networks with controlled geometries and functions.

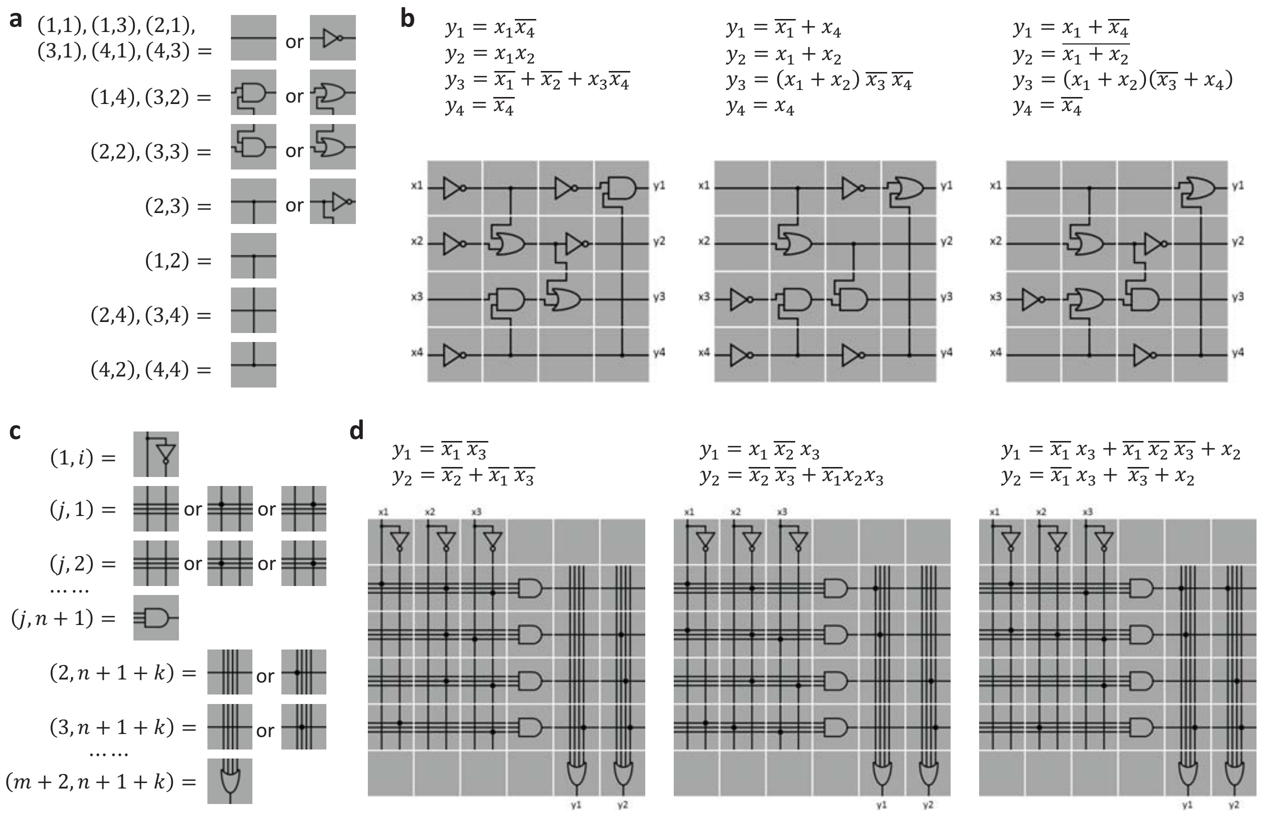


Figure S69: **Example design of combinatorial circuits. a,** A tile set for creating random feedforward logic circuit with 4 inputs and 4 outputs. The location of each tile in an 4 by 4 array is indicated as (i, j). **b,** Three example circuits in a total of $2^{11} = 2048$ distinct feedforward logic circuits that can be created in one test tube. **c,** A tile set for creating random programmable logic arrays with n inputs, m AND gates and l OR gates. $1 \le i \le n$, $2 \le j \le m+1$, $1 \le k \le l$. **d,** Three example logic arrays in a total of $3^{n \times m} \times 2^{m \times l}$ distinct logic arrays that can be created in one test tube, for $n = 3$, $m = 4$ and $l = 2$. The number of horizontal wires in tiles at locations $(j, 1)$ to $(j, n+1)$ and the number of vertical wires in tiles at locations $(2, n+1+k)$ to $(m+2, n+1+k)$ correspond to the value of n and m, respectively. Increasing numbers of wires in these tiles are required for larger n and m.

S9.3 Random molecular electronics, plasmonics and photonics

The fabrication of complex networks of metal nanoparticles and other nanostructures capable of energy transferring in electrons and photons is at the core of advancing all technologies involving molecular electronics, plasmonics and photonics. It remains a substantial challenge to scale up the complexity and improve controlled properties of the networks. For example, randomly self-assembled branched networks of gold nanoparticles exhibited interesting properties for guiding light at the subwavelength scale,[29,30] but with little control of the desired branching properties. Branched structure of silver nanowires that implement simple logic gates controlled by laser beams can be fabricated using chemical synthesis followed by structural rearrangement using a micromanipulator,[31] but this method would not scale well for building more complex photonic circuits.

A single DNA origami can be used to organize carbon nanotubes[32] and polymers[33] for building functional components of molecular electronics, and to organize metal nanoparticles,[34] nanorods[35,36] and organic dyes[37] for building functional components of molecular plasmonics and photonics. Using these approaches as building blocks, and using the principle of programmable disorder in random DNA origami arrays, it would be possible to create complex networks of molecular devices with controlled size distributions, branching properties, and circuit functions. These devices could be individually placed on lithographically patterned substrates[38,39] for their functions to be measured.

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Programmable disorder in random DNA tilings

Supplementary information (part II of II)

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S10 Cadnano diagrams

S10.1 Square DNA origami design with strong-weak bridge staples

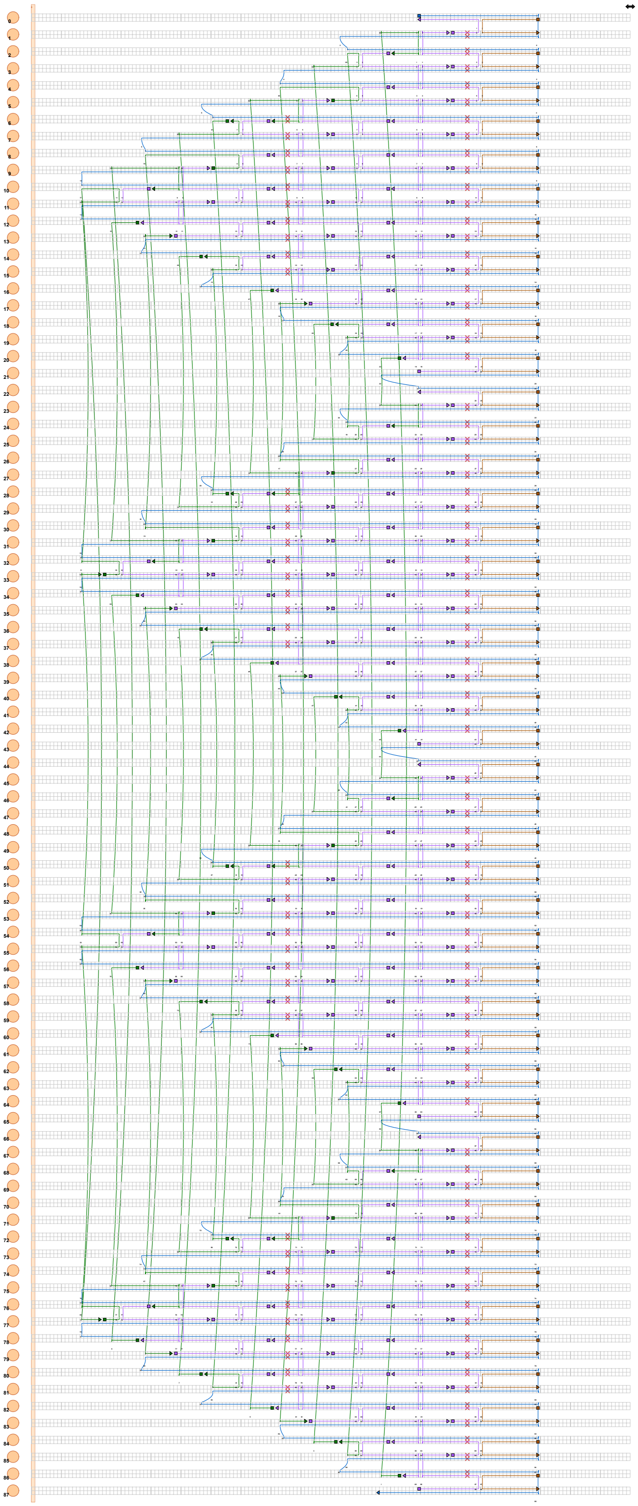

Figure S70: **Square DNA origami design with strong-weak bridge staples.**

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S10.2 Square DNA origami design with strong-strong bridge staples

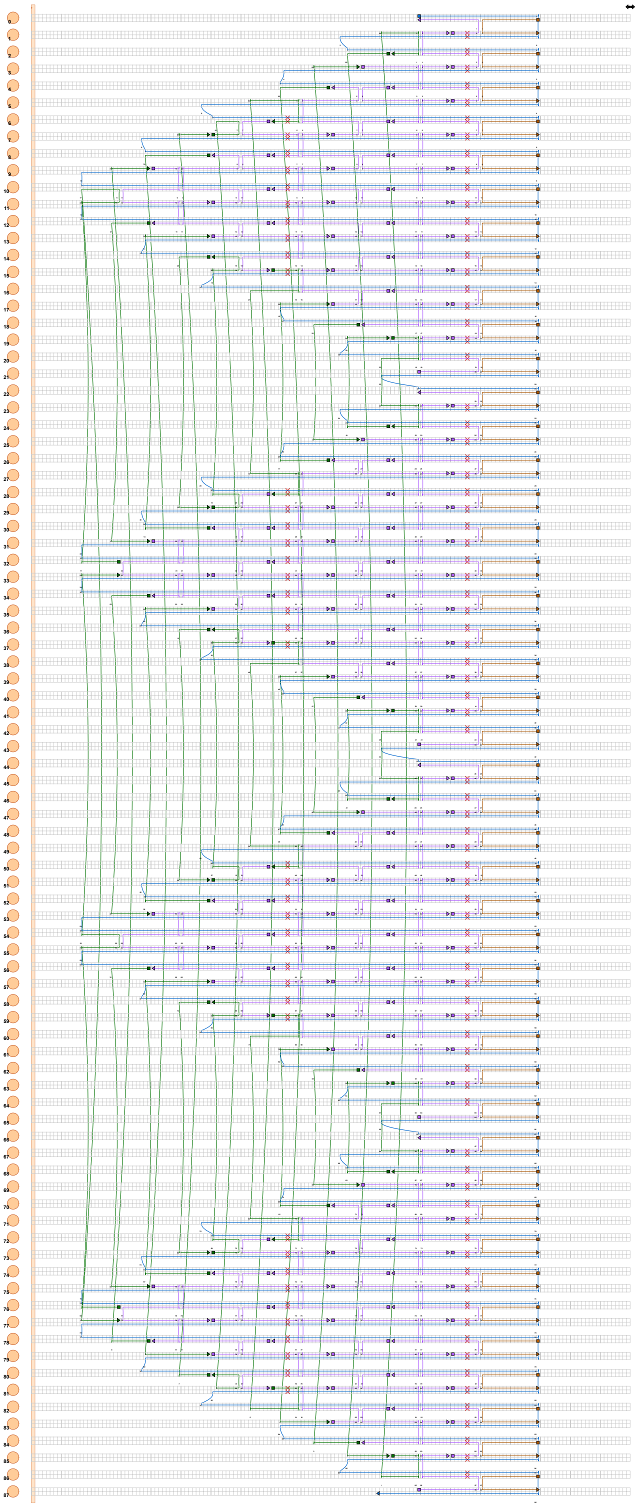

Figure S71: **Square DNA origami design with strong-strong bridge staples.**

S11 DNA sequences

S11.1 Interior staples and bridge staples

Table S1: Interior staples and strong-weak bridge staples.

Name	Sequence
Bri-T1R05C4sw	AAGCGAACAATTGCTGAATATAATGCTGTATTTTTTGTGAGAAA
Bri-T1R06C2sw	CCCGATTTAATCGTAAACGCCATCA
Bri-T1R09C2sw	CATTATTAGCAAAAGAAGTTTTGCCAGAGGGGGTTTTTTTGCCTTCCT
Bri-T1R12C1sw	ACAGATGATTCACCAGTAGCACCATTACCGACTTGA
Bri-T1R14C2sw	CCACTACTTTTTTGCCACCCTCAGAACCGCATT
Bri-T1R16C3sw	ACAACCATTTTTTCATACATGGCTTTTAAGCGCA
Bri-T1R18C4sw	CAACTATCTCAAGAGAAGGACAGGTTTTTTGATCAAAGGAA
Bri-T1R20C5sw	CTCATATTTTTTTCGCCACCCTCAGGTGTATC
Bri-T2R05C4sw	AGGAGTGTAAACATGAAAGTATTAAGAGGCTTTTTTGCGAATAA
Bri-T2R06C2sw	TACCGTTACCGATATATACGTAATG
Bri-T2R09C2sw	AGGCCGGAACCAGAGCCACCACCGGAACCGCCTCTTTTTTTACCTAAAA
Bri-T2R11C0sw	GTTAGGGAATTAGAGCTTTTTTCAGACCAGGCGCGTTGGGAAGATTTTTTCCAGGC
Bri-T2R12C1sw	AAGACTCCTAATATACAGTAACAGTACCGAAATTGC
Bri-T2R14C2sw	CTGAACATTTTTTTGAATAACCTTGCTTCTTAT
Bri-T2R16C3sw	TTTTATCTTTTTTATCCAATCGCAAGAGTTGGGT
Bri-T2R18C4sw	TAGGAATTAGCCTGTTTAGTAATTTTTTTTTGAAATCATCG
Bri-T2R20C5sw	TAATTTTTTTTTTTTTTCGAGCCAACAACGCC
Bri-T3R05C4sw	GCGAGAAAATAAACACCGGAATCATAATTATTTTTTCGCCCAAT
Bri-T3R06C2sw	ATGTATTACGCTAACGGAGAATTAA
Bri-T3R09C2sw	CGGGAGAATTTAATGGAAACAGTACATAAATCAATTTTTTTAGTCAGAG
Bri-T3R12C1sw	AACTCGTATTCCTGTGTGAAATTGTTATCCGAGCTC
Bri-T3R14C2sw	CACGCTGTTTTTTACCAGTGAGACGGGCAAGTT
Bri-T3R16C3sw	GCCAACATTTTTTCCACTATTAAAGAAATAGGGT
Bri-T3R18C4sw	TGCTGGTTGAGCTTGACGGGGACCTTTTTTAGAGTCGGCCT
Bri-T3R20C5sw	TAATCATTTTTTTCTTAATGCGCCCACGCTGC
Bri-T4R05C4sw	CCAACGTCATCGGAACCCTAAAGGGAGCCCTTTTTTGAACAATA
Bri-T4R06C2sw	CCAGTTTTCTGACCTGCAACAGTGC
Bri-T4R09C2sw	AATTCCACGTTTGCGTATTGGGCGCCAGGGTGGTTTTTTTTGCAAATGA
Bri-T4R11C0sw	AAAGCAATCATGGTCATTTTTTTTTGCCCGAACTCAGGTTTAACTTTTTTCAGTAT
Bri-T4R12C1sw	CTTCTGGTTCGTTAATAAAACGAACTAAATTATACC
Bri-T4R14C2sw	AAAATAATTTTTTTGTTTAGACTGGATAGCAAG
Bri-T4R16C3sw	ACAAGAGTTTTTTCGCGTTTTAATTCAAAAAGA
Bri-T4R18C4sw	TAAAGATTTGTTTTAAATATGTCGTTTTTTCTGACTGTAGG
Bri-T4R20C5sw	TTGTACTTTTTTTAACCTGTTTAGGACCATTA
Reg-T1R01C6	TCATTTGCTAATAGTAGTAGCATT
Reg-T1R02C5sw	GATACATTCAACTAAAGTACGGTGGGATGGCT
Reg-T1R03C6	TTTCATTGAGTAGATTTAGTTTCTATATTT
Reg-T1R04C5	TAGAGCTTCAGACCGGAAGCAAACCTATTATA
Reg-T1R05C6	GTCAGGAAGAGGTCATTTTTGCTCTGGAAG
Reg-T1R06C3	TTAAGAGGGTCCAATACTGCGGATAGCGAG
Reg-T1R06C5	GTCAGAAGATTGAATCCCCCTCAACCTCGTTT
Reg-T1R07C4sw	AAATATTCCAAAGCGGATTGCATCGAGCTTCA
Reg-T1R07C6	AACAGTTAGGTCTTTACCCTGATCCAACAG
Reg-T1R08C3	AGGCTTTTCAGGTAGAAAGATTCAATTACC
Reg-T1R08C5	ACCAGACGGAATACCACATTCAACGAGATGGT
Reg-T1R09C4	AGATTTAGACGATAAAAACCAAAAATCGTCAT
Reg-T1R09C6	ATACATACAACACTATCATAACATGCTTTA
Reg-T1R10C1sw	AGTCAGGACATAGGCTGGCTGACCTTTGAAAGAGG

Name	Sequence
Reg-T1R10C3	TTATGCGATTGACAAGAACCGGAGGTCAAT
Reg-T1R10C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTT
Reg-T1R11C2sw	GAGTAATCTTTTAAGAACTGGCTCCGGAACAA
Reg-T1R11C4	ACCCAAATAACTTTAATCATTGTGATCAGTTG
Reg-T1R11C6	GTGAATATAGTAAATTGGGCTTTAATGCAG
Reg-T1R12C3sw	CATAAGGGACACTAAAACACTCACATTAAA
Reg-T1R12C5	ACTTAGCCATTATACCAAGCGCGAGAGGACTA
Reg-T1R13C1sw	CGAAAGAGGCAAAAGAATAACCGAACTGACCAACTTCATCAA
Reg-T1R13C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATT
Reg-T1R13C6	ACAACGGAAATCCGCGACCTGCCTCATTCA
Reg-T1R14C3sw	CGGGTAAAATTCGGTCGCTGAGGAATGACA
Reg-T1R14C5	AAGACTTTGGCCGCTTTTGCGGGATTAAACAG
Reg-T1R15C4	GAGTTAAATTCATGAGGAAGTTTCTCTTTGAC
Reg-T1R15C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGT
Reg-T1R16C5sw	CTTGATACTGAAAATCTCCAAAAAAAGCGGAGT
Reg-T1R17C4sw	TAATTTTTTCACGTCGATAGTTGCGCCGACCTTGCAGG
Reg-T1R17C6	CAAAAGGTTCGAGGTGAATTTCTCGTCACC
Reg-T1R18C5sw	GAGAATAGTAAAGTTTTGTCGTCTCAGCC
Reg-T1R19C6	GTTAGTAACTTTCAACAGTTTCAAAGGCTC
Reg-T1R21C5	CCATGTACCGTAACACTGTAGCATTCCACAGATTCCAGAC
Reg-T2R01C6	ACCCTCATTCAGGGATAGCAAGCC
Reg-T2R02C5sw	ACCGTACTTTAGGATTAGCGGGGTGGAACCTA
Reg-T2R03C6	GTACCAGGTATAGCCCGGAATAGAACCGCC
Reg-T2R04C5	TTATTCTGACTGGTAATAAGTTTTAACAAATA
Reg-T2R05C6	CAGTGCCCCCCCTGCCTATTTCTTTGCTCA
Reg-T2R06C3	GTCTCTGACACCCTCAGAGCCACATCAAAA
Reg-T2R06C5	AATCCTCAACCAGAACCACCACCAGCCCCCTT
Reg-T2R07C4sw	GAGCCGCCTTAAAGCCAGAATGGAGATGATAC
Reg-T2R07C6	GCCAGCAGCCTTGATATTCACAAACGGGGT
Reg-T2R08C3	TCACCGGAAACGTCACCAATGAATTATTCA
Reg-T2R08C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGG
Reg-T2R09C4	TAGCAGCATTGCCATCTTTTCATACACCCTCA
Reg-T2R09C6	AGTTTGCGCATTTTCGGTCATAGAGCCGCC
Reg-T2R10C1sw	GCCATTTGCAAACGTAGAAAATACCTGGCATGATT
Reg-T2R10C3	TTAAAGGTACATATAAAAGAAACAAACGCA
Reg-T2R10C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAAC
Reg-T2R11C2sw	AGGTGGCAGAATTATCACCGTCACCATTAGCA
Reg-T2R11C4	ACCACGGATAAATATTGACGGAAAACCATCGA
Reg-T2R11C6	TAGAAAAGGCGACATTCAACCGCAGAATCA
Reg-T2R12C3sw	ATAATAACTCAGAGAGATAACCCGAAGCGC
Reg-T2R12C5	AAAGTTACGCCCAATAATAAGAGCAGCCTTTA
Reg-T2R13C1sw	GGTAATTGAGCGCTAATAGGAATACCCAAAAGAAATACATAA
Reg-T2R13C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGAC
Reg-T2R13C6	ATGAAATGAAAAGTAAGCAGATACAATCAA
Reg-T2R14C3sw	ATTAGACGGAGCGTCTTTCCAGAGCTACAA
Reg-T2R14C5	CAGAGAGAACAAAATAAACAGCCATTAAATCA
Reg-T2R15C4	TGCCAGTTATAACATAAAAACAGGACAAGAAT
Reg-T2R15C6	ATCCCAAAAAAAATGAAAATAGCAAGAAACA
Reg-T2R16C5sw	AGATTAGTATATAGAAGGCTTATCCAAGCCGT
Reg-T2R17C4sw	AGCAAGCAAATCAGTGCTATTTTGCACCCAGCCTAATT
Reg-T2R17C6	TAAGAACGGAGGTTTTGAAGCCTATTATTT
Reg-T2R18C5sw	TTTTATTTCCAATCAATAATCGGCCATCC
Reg-T2R19C6	CTTATCACTCATCGAGAACAAGCGGTATTC

Name	Sequence
Reg-T2R21C5	AGCTAATGCAGAACGCGAGAAAAATAATATCCTGTCTTTC
Reg-T3R01C6	AGAATATCAGACGACGACAATAAA
Reg-T3R02C5sw	AACATGTATCATATGCGTTATACAAAGGCGTT
Reg-T3R03C6	CCAGTATGAATCGCCATATTTAGTAATAAG
Reg-T3R04C5	AAATAAGAACTTTTTCAAATATATCTGAGAGA
Reg-T3R05C6	ATTTCATGACCGTGTGATAAATAATTCTTA
Reg-T3R06C3	TATATAACGTAAATCGTCGCTATATTTGAA
Reg-T3R06C5	CTACCTTTAGAATCCTTGAAAACAAGAAAACA
Reg-T3R07C4sw	TTTCCCTTTTAACCTCCGGCTTAGCAAAGAAC
Reg-T3R07C6	GCTTAGAATCAAAATCATAGGTTTTAGTTA
Reg-T3R08C3	TTACCTTTACAATAACGGATTCGCAAAATT
Reg-T3R08C5	AAATTAATACCAAGTTACAAAATCCTGAATAA
Reg-T3R09C4	CTTTGAATTACATTTAACAATTTCTAATTAAT
Reg-T3R09C6	GCGAATTATGAAACAAACATCATAGCGATA
Reg-T3R10C1sw	GTAGATTTGTTATTAATTTTAAAAAAACAATTCGAC
Reg-T3R10C3	ATTTGCACCATTTTGCGGAACAAATTTGAG
Reg-T3R10C5	TGGAAGGGAGCGGAATTATCATCAACTAATAG
Reg-T3R11C2sw	AACATTATGTAAAACAGAAATAAATTTTACAT
Reg-T3R11C4	CCAGAAGGTTAGAACCTACCATATCCTGATTG
Reg-T3R11C6	ATTATCAGTTTGGATTATACTTGCGCAGAG
Reg-T3R12C3sw	GATTTAGATTGCTGAACCTCAAAGTATTAA
Reg-T3R12C5	ATTAGAGCAATATCTGGTCAGTTGCAGCAGAA
Reg-T3R13C1sw	AAAATCTAAAGCATCACCAGTATTAGACTTTACAGTTTGAGT
Reg-T3R13C4	CCTCAATCCGTCAATAGATAATACAGAAACCA
Reg-T3R13C6	ACAGTTGTTAGGAGCACTAACATATTCCTG
Reg-T3R14C3sw	CACCGCCTGAAAGCGTAAGAATACATTCTG
Reg-T3R14C5	GATAAAACTTTTTGAATGGCTATTTTCACCAG
Reg-T3R15C4	AGACAATAAGAGGTGAGGCGGTCATATCAAAC
Reg-T3R15C6	ATGCGCGTACCGAACGAACCACGCAAATCA
Reg-T3R16C5sw	TCACACGATGCAACAGGAAAAACGGAAGAACT
Reg-T3R17C4sw	TTACCGCCAGCCATCCAGTAATAAAAGGGACGTGGCAC
Reg-T3R17C6	AATACCTATTTACATTGGCAGAAGTCTTTA
Reg-T3R18C5sw	CAAACTATAAAAGAGTCTGTCCATTTTTA
Reg-T3R19C6	TTAACCGTCACTTGCCTGAGTACTCATGGA
Reg-T3R21C5	CTAAACAGGAGGCCGATAATCCTGAGAAGTGTCACGCAAA
Reg-T4R01C6	GCGCGTACTTTCCTCGTTAGAATC
Reg-T4R02C5sw	GCGTAACCAAAGCCGGCGAACGTGTGCCGTAA
Reg-T4R03C6	GGAAGGGGGCAAGTGTAGCGGTGCTACAGG
Reg-T4R04C5	AGCACTAAAAAGGGCGAAAAACCGAAATCCCT
Reg-T4R05C6	GGCGATGTTTTTGGGGTCGAGGGCGAGAAA
Reg-T4R06C3	TGAGTGTTCAGCTGATTGCCCTTGCGCGGG
Reg-T4R06C5	TATAAATCGAGAGTTGCAGCAAGCGTCGTGCC
Reg-T4R07C4sw	GGCCCTGAAAAAGAATAGCCCGAGCGTGGACT
Reg-T4R07C6	CTGGTTTGTTCCGAAATCGGCATCTATCAG
Reg-T4R08C3	GAGAGGCGACAACATACGAGCCGCTGCAGG
Reg-T4R08C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACG
Reg-T4R09C4	AAGTGTAATAATGAATCGGCCAACCACCGCCT
Reg-T4R09C6	CTAACTCCCAGTCGGGAAACCTGGTCCACG
Reg-T4R10C1sw	GAATTCGTGCCATTCGCCATTCAGTTCCGGCACCG
Reg-T4R10C3	TCGACTCTGAAGGGCGATCGGTGCGGCCTC
Reg-T4R10C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCC
Reg-T4R11C2sw	ACTGTTGGAGAGGATCCCCGGGTACCGCTCAC
Reg-T4R11C4	TTCGCTATTGCCAAGCTTGCATGCGAAGCATA

Name	Sequence
Reg-T4R11C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAG
Reg-T4R12C3sw	AGGAAGATCATTAAATGTGAGCGTTTTTAA
Reg-T4R12C5	AGTTTGAGATTCTCCGTGGGAACAATTCGCAT
Reg-T4R13C1sw	GTAGCCAGCTTTCATCAACGCACTCCAGCCAGCTGCTGCGCA
Reg-T4R13C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTC
Reg-T4R13C6	ATTGACCCGCATCGTAACCGTGAGGGGGAT
Reg-T4R14C3sw	CCAATAGGAAACTAGCATGTCAAGGAGCAA
Reg-T4R14C5	TAAATTTTTGATAATCAGAAAAGCACAAAGGC
Reg-T4R15C4	ACCCCGGTTGTTAAATCAGCTCATAGTAACAA
Reg-T4R15C6	CAGGAAGTAATATTTTGTTAAAAACGGCGG
Reg-T4R16C5sw	TATCAGGTAAATCACCATCAATATCAATGCCT
Reg-T4R17C4sw	GGCCGGAGACAGTCCATTGCCTGAGAGTCTTCATATGT
Reg-T4R17C6	ACCGTTCATTTTTGAGAGATCTCCCAAAAA
Reg-T4R18C5sw	GAGTAATGCCTGTAATACTTTTGCATCGG
Reg-T4R19C6	CCTTTATCATATATTTTAAATGGATATTCA
Reg-T4R21C5	AATCATACAGGCAAGGCAGAGCATAAAGCTAAGGGAGAAG

Table S2: Interior staples and strong-strong bridge staples.

Name	Sequence
Bri-T1R02C5	GATACATTTCGCTTTTTTGACCCTGTAAT
Bri-T1R04C4	AATATAATGCTGTATTTTTTTGTGAGAAAGGCCGG
Bri-T1R07C2	TGGATAGCAAGCCCGATTTTTAATCGTAAACGCCAT
Bri-T1R08C2	AGTTTTGCCAGAGGGGGTTTTGCCTTCCTGTAGCCAGCT
Bri-T1R12C1	AGGACAGATGATTTTTTCACCAGTAGC
Bri-T1R14C2	TGCCACTACTTTTTTTGCCACCCTC
Bri-T1R15C3	GCTGAGGAATGACAACAACCATTTTTTCATACATGGCTTTTAAGCGCA
Bri-T1R18C4	AAAGGAACAACTATTTTCTCAAGAGAAGGA
Bri-T1R19C5	TGTCGTCTCAGCCCTCATATTTTTTTCGCCACCCTCAGGTGTATC
Bri-T2R02C5	ACCGTACTCAGGTTTTTGATCTAAAGTTT
Bri-T2R04C4	AAGTATTAAGAGGCTTTTTTTGCGAATAATAATTT
Bri-T2R07C2	AGAACCGCATTTACCGTTTTACCGATATATACGTAA
Bri-T2R08C2	CACCACCGGAACCGCCTCTTTACCTAAAACGAAAGAGGC
Bri-T2R10C0	GGAATTAGAGCTTTTTTTTCAGACCAGGCGCGTTGGGAAGATTTTTTTTCCAGGCAAAGC
Bri-T2R12C1	ATTAAGACTCCTTTTTAATATACAGTA
Bri-T2R14C2	AACTGAACATTTTTTTTGAATAACC
Bri-T2R15C3	TTCCAGAGCTACAATTTTATCTTTTTTATCCAATCGCAAGAGTTGGGT
Bri-T2R18C4	TCATCGTAGGAATTTTTAGCCTGTTTAGTA
Bri-T2R19C5	TAATCGGCCATCCTAATTTTTTTTTTTTTTCGAGCCAACAACGCC
Bri-T3R02C5	AACATGTAATTTTTTTTGAAACCAATCAA
Bri-T3R04C4	CGGAATCATAATTATTTTTTTCGCCCAATAGCAAG
Bri-T3R07C2	TTGCTTCTTATATGTATTTTACGCTAACGGAGAATT
Bri-T3R08C2	AAACAGTACATAAATCAATTTAGTCAGAGGGTAATTGAG
Bri-T3R12C1	GACAACTCGTATTTTTTCCTGTGTGAA
Bri-T3R14C2	GCCACGCTGTTTTTTTACCAGTGAG
Bri-T3R15C3	AAGAATACATTCTGGCCAACATTTTTTCCACTATTAAAGAAATAGGGT
Bri-T3R18C4	CGGCCTTGCTGGTTTTTGAGCTTGACGGGG
Bri-T3R19C5	CTGTCCATTTTTATAATCATTTTTTTCTTAATGCGCCCACGCTGC
Bri-T4R02C5	GCGTAACCACCATTTTTGAGTAAAAGAGT
Bri-T4R04C4	CCTAAAGGGAGCCCTTTTTTTGAACAATATTACCG
Bri-T4R07C2	ACGGGCAAGTTCCAGTTTTTTCTGACCTGCAACAGT
Bri-T4R08C2	ATTGGGCGCCAGGGTGGTTTTGCAAATGAAAAATCTAAA
Bri-T4R10C0	AATCATGGTCATTTTTTTTTTGCCCGAACTCAGGTTTAACTTTTTTTTCAGTATGTTAG
Bri-T4R12C1	CCGCTTCTGGTTTTTTCGTTAATAAAA
Bri-T4R14C2	CAAAAATAATTTTTTTTGTTTAGAC
Bri-T4R15C3	ATGTCAAGGAGCAAACAAGAGTTTTTTTCGCGTTTTAATTCAAAAAGA
Bri-T4R18C4	TGTAGGTAAAGATTTTTTGTTTTAAATATG
Bri-T4R19C5	ACTTTTGCATCGGTTGTACTTTTTTTAACCTGTTTAGGACCATTA
Reg-T1R01C6	TCATTTGCTAATAGTAGTAGCATT
Reg-T1R03C5	CAACTAAAGTACGGTGGGATGGCT
Reg-T1R03C6	TTTCATTGAGTAGATTTAGTTTCTATATTT
Reg-T1R04C5	TAGAGCTTCAGACCGGAAGCAAACCTATTATA
Reg-T1R05C6	GTCAGGAAGAGGTCATTTTTGCTCTGGAAG
Reg-T1R06C3	TTAAGAGGGTCCAATACTGCGGATAGCGAG
Reg-T1R06C5	GTCAGAAGATTGAATCCCCCTCAACCTCGTTT
Reg-T1R07C4	AAATATTCCAAAGCGGATTGCATCGAGCTTCAAAGCGAACAATTGCTG
Reg-T1R07C6	AACAGTTAGGTCTTTACCCTGATCCAACAG
Reg-T1R08C3	AGGCTTTTCAGGTAGAAAGATTCAATTACC
Reg-T1R08C5	ACCAGACGGAATACCACATTCAACGAGATGGT
Reg-T1R09C1	CGAACTAAATTATACCAGTCAGGACATAGGCTGGCTGACCTTTGAAAG
Reg-T1R09C4	AGATTTAGACGATAAAAACCAAAAATCGTCAT
Reg-T1R09C6	ATACATACAACACTATCATAACATGCTTTA

Name	Sequence
Reg-T1R10C3	TTATGCGATTGACAAGAACCGGAGGTCAAT
Reg-T1R10C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTT
Reg-T1R11C2	GAGTAATCTTTTAAGAACTGGCTCCGGAACAACATTATTAGCAAAAGA
Reg-T1R11C4	ACCCAAATAACTTTAATCATTGTGATCAGTTG
Reg-T1R11C6	GTGAATATAGTAAATTGGGCTTTAATGCAG
Reg-T1R12C3	CATAAGGGACACTAAAACACTCACATTAAACGGGTAAAATTCGGTC
Reg-T1R12C5	ACTTAGCCATTATACCAAGCGCGAGAGGACTA
Reg-T1R13C2	AAAAGAATAACCGAACTGACCAACTTCATCAA
Reg-T1R13C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATT
Reg-T1R13C6	ACAACGGAAATCCGCGACCTGCCTCATTCA
Reg-T1R14C5	AAGACTTTGGCCGCTTTTGCGGGATTAAACAG
Reg-T1R15C4	GAGTTAAATTCATGAGGAAGTTTCTCTTTGAC
Reg-T1R15C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGT
Reg-T1R16C5	CTTGATACTGAAAATCTCCAAAAAAAGCGGAGTGAGAATAG
Reg-T1R17C4	TTTCACGTCGATAGTTGCGCCGACCTTGCAGG
Reg-T1R17C6	CAAAAGGTTCGAGGTGAATTTCTCGTCACC
Reg-T1R19C6	GTTAGTAACTTTCAACAGTTTCAAAGGCTC
Reg-T1R21C5	CCATGTACCGTAACACTGTAGCATTCCACAGATTCCAGAC
Reg-T2R01C6	ACCCTCATTCAGGGATAGCAAGCC
Reg-T2R03C5	TTAGGATTAGCGGGGTGGAACCTA
Reg-T2R03C6	GTACCAGGTATAGCCCGGAATAGAACCGCC
Reg-T2R04C5	TTATTCTGACTGGTAATAAGTTTTAACAAATA
Reg-T2R05C6	CAGTGCCCCCCCTGCCTATTTCTTTGCTCA
Reg-T2R06C3	GTCTCTGACACCCTCAGAGCCACATCAAAA
Reg-T2R06C5	AATCCTCAACCAGAACCACCACCAGCCCCCTT
Reg-T2R07C4	GAGCCGCCTTAAAGCCAGAATGGAGATGATACAGGAGTGTAAACATGA
Reg-T2R07C6	GCCAGCAGCCTTGATATTCACAAACGGGGT
Reg-T2R08C3	TCACCGGAAACGTCACCAATGAATTATTCA
Reg-T2R08C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGG
Reg-T2R09C1	ACCATTACCGACTTGAGCCATTTGCAAACGTAGAAAATACCTGGCATG
Reg-T2R09C4	TAGCAGCATTGCCATCTTTTCATACACCCTCA
Reg-T2R09C6	AGTTTGCGCATTTTCGGTCATAGAGCCGCC
Reg-T2R10C3	TTAAAGGTACATATAAAAGAAACAAACGCA
Reg-T2R10C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAAC
Reg-T2R11C2	AGGTGGCAGAATTATCACCGTCACCATTAGCAAGGCCGGAACCAGAGC
Reg-T2R11C4	ACCACGGATAAATATTGACGGAAAACCATCGA
Reg-T2R11C6	TAGAAAAGGCGACATTCAACCGCAGAATCA
Reg-T2R12C3	ATAATAACTCAGAGAGATAACCCGAAGCGCATTAGACGGAGCGTCT
Reg-T2R12C5	AAAGTTACGCCCAATAATAAGAGCAGCCTTTA
Reg-T2R13C2	CGCTAATAGGAATACCCAAAAGAAATACATAA
Reg-T2R13C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGAC
Reg-T2R13C6	ATGAAATGAAAAGTAAGCAGATACAATCAA
Reg-T2R14C5	CAGAGAGAACAAAATAAACAGCCATTAAATCA
Reg-T2R15C4	TGCCAGTTATAACATAAAAACAGGACAAGAAT
Reg-T2R15C6	ATCCCAAAAAAAATGAAAATAGCAAGAAACA
Reg-T2R16C5	AGATTAGTATATAGAAGGCTTATCCAAGCCGTTTTTATTT
Reg-T2R17C4	CAAATCAGTGCTATTTTGCACCCAGCCTAATT
Reg-T2R17C6	TAAGAACGGAGGTTTTGAAGCCTATTATTT
Reg-T2R19C6	CTTATCACTCATCGAGAACAAGCGGTATTC
Reg-T2R21C5	AGCTAATGCAGAACGCGAGAAAAATAATATCCTGTCTTTC
Reg-T3R01C6	AGAATATCAGACGACGACAATAAA
Reg-T3R03C5	TCATATGCGTTATACAAAGGCGTT
Reg-T3R03C6	CCAGTATGAATCGCCATATTTAGTAATAAG

Name	Sequence
Reg-T3R04C5	AAATAAGAACTTTTTCAAATATATCTGAGAGA
Reg-T3R05C6	ATTTCATGACCGTGTGATAAATAATTCTTA
Reg-T3R06C3	TATATAACGTAAATCGTCGCTATATTTGAA
Reg-T3R06C5	CTACCTTTAGAATCCTTGAAAACAAGAAAACA
Reg-T3R07C4	TTTCCCTTTTAACCTCCGGCTTAGCAAAGAACGCGAGAAAATAAACAC
Reg-T3R07C6	GCTTAGAATCAAAATCATAGGTTTTAGTTA
Reg-T3R08C3	TTACCTTTACAATAACGGATTCGCAAAATT
Reg-T3R08C5	AAATTAATACCAAGTTACAAAATCCTGAATAA
Reg-T3R09C1	ACAGTACCGAAATTGCGTAGATTTGTTATTAATTTTAAAAAACAATTC
Reg-T3R09C4	CTTTGAATTACATTTAACAATTTCTAATTAAT
Reg-T3R09C6	GCGAATTATGAAACAAACATCATAGCGATA
Reg-T3R10C3	ATTTGCACCATTTTGCGGAACAAATTTGAG
Reg-T3R10C5	TGGAAGGGAGCGGAATTATCATCAACTAATAG
Reg-T3R11C2	AACATTATGTAAAACAGAAATAAATTTTACATCGGGAGAATTTAATGG
Reg-T3R11C4	CCAGAAGGTTAGAACCTACCATATCCTGATTG
Reg-T3R11C6	ATTATCAGTTTGGATTATACTTGCGCAGAG
Reg-T3R12C3	GATTTAGATTGCTGAACCTCAAAGTATTAACACCGCCTGAAAGCGT
Reg-T3R12C5	ATTAGAGCAATATCTGGTCAGTTGCAGCAGAA
Reg-T3R13C2	GCATCACCAGTATTAGACTTTACAGTTTGAGT
Reg-T3R13C4	CCTCAATCCGTCAATAGATAATACAGAAACCA
Reg-T3R13C6	ACAGTTGTTAGGAGCACTAACATATTCCTG
Reg-T3R14C5	GATAAAACTTTTTGAATGGCTATTTTCACCAG
Reg-T3R15C4	AGACAATAAGAGGTGAGGCGGTCATATCAAAC
Reg-T3R15C6	ATGCGCGTACCGAACGAACCACGCAAATCA
Reg-T3R16C5	TCACACGATGCAACAGGAAAAACGGAAGAACTCAAACTAT
Reg-T3R17C4	CCAGCCATCCAGTAATAAAAGGGACGTGGCAC
Reg-T3R17C6	AATACCTATTTACATTGGCAGAAGTCTTTA
Reg-T3R19C6	TTAACCGTCACTTGCCTGAGTACTCATGGA
Reg-T3R21C5	CTAAACAGGAGGCCGATAATCCTGAGAAGTGTCACGCAAA
Reg-T4R01C6	GCGCGTACTTTCCTCGTTAGAATC
Reg-T4R03C5	AAAGCCGGCGAACGTGTGCCGTAA
Reg-T4R03C6	GGAAGGGGGCAAGTGTAGCGGTGCTACAGG
Reg-T4R04C5	AGCACTAAAAAGGGCGAAAAACCGAAATCCCT
Reg-T4R05C6	GGCGATGTTTTTGGGGTCGAGGGCGAGAAA
Reg-T4R06C3	TGAGTGTTCAGCTGATTGCCCTTGCGCGGG
Reg-T4R06C5	TATAAATCGAGAGTTGCAGCAAGCGTCGTGCC
Reg-T4R07C4	GGCCCTGAAAAAGAATAGCCCGAGCGTGGACTCCAACGTCATCGGAAC
Reg-T4R07C6	CTGGTTTGTTCCGAAATCGGCATCTATCAG
Reg-T4R08C3	GAGAGGCGACAACATACGAGCCGCTGCAGG
Reg-T4R08C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACG
Reg-T4R09C1	ATTGTTATCCGAGCTCGAATTCGTGCCATTCGCCATTCAGTTCCGGCA
Reg-T4R09C4	AAGTGTAATAATGAATCGGCCAACCACCGCCT
Reg-T4R09C6	CTAACTCCCAGTCGGGAAACCTGGTCCACG
Reg-T4R10C3	TCGACTCTGAAGGGCGATCGGTGCGGCCTC
Reg-T4R10C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCC
Reg-T4R11C2	ACTGTTGGAGAGGATCCCCGGGTACCGCTCACAATTCCACGTTTGCGT
Reg-T4R11C4	TTCGCTATTGCCAAGCTTGCATGCGAAGCATA
Reg-T4R11C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAG
Reg-T4R12C3	AGGAAGATCATTAAATGTGAGCGTTTTTAACCAATAGGAAACTAGC
Reg-T4R12C5	AGTTTGAGATTCTCCGTGGGAACAATTCGCAT
Reg-T4R13C2	TTCATCAACGCACTCCAGCCAGCTGCTGCGCA
Reg-T4R13C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTC
Reg-T4R13C6	ATTGACCCGCATCGTAACCGTGAGGGGGAT

Name	Sequence
Reg-T4R14C5	TAAATTTTTGATAATCAGAAAAGCACAAAGGC
Reg-T4R15C4	ACCCCGGTTGTTAAATCAGCTCATAGTAACAA
Reg-T4R15C6	CAGGAAGTAATATTTTGTTAAAAACGGCGG
Reg-T4R16C5	TATCAGGTAAATCACCATCAATATCAATGCCTGAGTAATG
Reg-T4R17C4	AGACAGTCCATTGCCTGAGAGTCTTCATATGT
Reg-T4R17C6	ACCGTTCATTTTTGAGAGATCTCCCAAAAA
Reg-T4R19C6	CCTTTATCATATATTTTAAATGGATATTCA
Reg-T4R21C5	AATCATACAGGCAAGGCAGAGCATAAAGCTAAGGGAGAAG

S11.2 Edge staples with double hairpins for creating inert edges

Table S3: A full set of edge staples that each are capped with two hairpins.

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4R00C7-DHP	GTGTCGTAGACACGAGCACGTATAACGTGCTATGGTTGCTTTGACGTGTCGTAGACAC
Edg-T4R02C7-DHP	GTGTCGTAGACACCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGGTGTCGTAGACAC
Edg-T4R04C7-DHP	GTGTCGTAGACACATCACCCAAATCAAGTGCCCACTACGTGAACCGTGTCGTAGACAC
Edg-T4R06C7-DHP	GTGTCGTAGACACATCCTGTTTGATGGTGGCCCCAGCAGGCGAAAGTGTCGTAGACAC
Edg-T4R08C7-DHP	GTGTCGTAGACACGCTCACTGCCCGCTTTACATTAATTGCGTTGCGTGTCGTAGACAC
Edg-T4R10C7-DHP	GTGTCGTAGACACGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGGTGTCGTAGACAC
Edg-T4R12C7-DHP	GTGTCGTAGACACCGTTGGTGTAGATGGGGTAATGGGATAGGTCAGTGTCGTAGACAC
Edg-T4R14C7-DHP	GTGTCGTAGACACTTTAAATTGTAAACGTATTGTATAAGCAAATAGTGTCGTAGACAC
Edg-T4R16C7-DHP	GTGTCGTAGACACGCCGGAGAGGGTAGCTTAGCTGATAAATTAATGTGTCGTAGACAC
Edg-T4R18C7-DHP	GTGTCGTAGACACAAATTTTTAGAACCCTTTCAACGCAAGGATAAGTGTCGTAGACAC
Edg-T4R20C7-DHP	GTGTCGTAGACACTAAGCAATAAAGCCTCAAAGAATTAGCAAAATGTGTCGTAGACAC

S11.3 Edge staples with stacking bonds

Table S4: A full set of edge staples that each have two stacking bonds.

Name	Sequence
Edg-T1R00C7	GGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1R02C7	TCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1R04C7	ATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1R06C7	CCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1R08C7	CGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1R10C7	GAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1R12C7	CTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1R14C7	GAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1R16C7	GGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1R18C7	GGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1R20C7	ACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2R00C7	AGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2R02C7	GAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2R04C7	GTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2R06C7	GCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2R08C7	TAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2R10C7	GCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2R12C7	CCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2R14C7	TTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2R16C7	AACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2R18C7	TAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2R20C7	AGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3R00C7	GTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3R02C7	AGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3R04C7	AATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3R06C7	AGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3R08C7	TGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3R10C7	CAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3R12C7	GTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3R14C7	ACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3R16C7	TCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3R18C7	TTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3R20C7	AGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4R00C7	GAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4R02C7	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4R04C7	ATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4R06C7	ATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4R08C7	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4R10C7	GTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4R12C7	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4R14C7	TTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4R16C7	GCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4R18C7	AAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4R20C7	TAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

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S11.4 Extended edge staples with stacking bonds

Table S5: A full set of extended edge staples and the helper strand.

Name	Sequence
Edg-T1R00C7-EXT	CGTTTCCTTTGGTGGCATCAATTCTAGGGCGCGAGCTGAAAATTTCCTTTCG
Edg-T1R02C7-EXT	CGTTTCCTTTTCCCAATTCTGCGAACCCATATAACAGTTGATTTTCCTTTCG
Edg-T1R04C7-EXT	CGTTTCCTTTATTGCTCCTTTTGATATTAGAGAGTACCTTTATTTCCTTTCG
Edg-T1R06C7-EXT	CGTTTCCTTTCCATAAATCAAAAATCCAGAAAACGAGAATGATTTCCTTTCG
Edg-T1R08C7-EXT	CGTTTCCTTTCGAGGCATAGTAAGAGACGCCAAAAGGAATTATTTCCTTTCG
Edg-T1R10C7-EXT	CGTTTCCTTTGAAACACCAGAACGAGAGGCTTGCCCTGACGATTTCCTTTCG
Edg-T1R12C7-EXT	CGTTTCCTTTCTGATAAATTGTGTCGAGATTTGTATCATCGCTTTCCTTTCG
Edg-T1R14C7-EXT	CGTTTCCTTTGAACGAGGGTAGCAACGCGAAAGACAGCATCGTTTCCTTTCG
Edg-T1R16C7-EXT	CGTTTCCTTTGGTTTATCAGCTTGCTAGCCTTTAATTGTATCTTTCCTTTCG
Edg-T1R18C7-EXT	CGTTTCCTTTGGGATTTTGCTAAACAAATGAATTTTCTGTATTTTCCTTTCG
Edg-T1R20C7-EXT	CGTTTCCTTTACAAACTACAACGCCTGAGTTTCGTCACCAGTTTTCCTTTCG
Edg-T2R00C7-EXT	CGTTTCCTTTAGCCACCACCCTCATTGAACCGCCACCCTCAGTTTCCTTTCG
Edg-T2R02C7-EXT	CGTTTCCTTTGAGAGGGTTGATATAAGCGGATAAGTGCCGTCTTTCCTTTCG
Edg-T2R04C7-EXT	CGTTTCCTTTGTATAAACAGTTAATGTTGAGTAACAGTGCCCTTTCCTTTCG
Edg-T2R06C7-EXT	CGTTTCCTTTGCAGGTCAGACGATTGTTGACAGGAGGTTGAGTTTCCTTTCG
Edg-T2R08C7-EXT	CGTTTCCTTTTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGTTTCCTTTCG
Edg-T2R10C7-EXT	CGTTTCCTTTGCGCCAAAGACAAAAGTTCATATGGTTTACCATTTCCTTTCG
Edg-T2R12C7-EXT	CGTTTCCTTTCCGAAGCCCTTTTTAAAGCAATAGCTATCTTATTTCCTTTCG
Edg-T2R14C7-EXT	CGTTTCCTTTTTTTTTGTTTAACGTCTCCAAATAAGAAACGATTTCCTTTCG
Edg-T2R16C7-EXT	CGTTTCCTTTAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGTTTCCTTTCG
Edg-T2R18C7-EXT	CGTTTCCTTTTAAACCAAGTACCGCATTCCAAGAACGGGTATTTTCCTTTCG
Edg-T2R20C7-EXT	CGTTTCCTTTAGATAAGTCCTGAACACCTGTTTATCAACAATTTTCCTTTCG
Edg-T3R00C7-EXT	CGTTTCCTTTGTAAAGTAATTCTGTCAAAGTACCGACAAAAGTTTCCTTTCG
Edg-T3R02C7-EXT	CGTTTCCTTTAGTAGGGCTTAATTGAAAAGCCAACGCTCAACTTTCCTTTCG
Edg-T3R04C7-EXT	CGTTTCCTTTAATGGTTTGAAATACCCTTCTGACCTAAATTTTTTCCTTTCG
Edg-T3R06C7-EXT	CGTTTCCTTTAGTCAATAGTGAATTTTTAAGACGCTGAGAAGTTTCCTTTCG
Edg-T3R08C7-EXT	CGTTTCCTTTGAGCAAAAGAAGATGATTCATTTCAATTACCTTTCCTTTCG
Edg-T3R10C7-EXT	CGTTTCCTTTCAATATAATCCTGATTGATGATGGCAATTCATTTTCCTTTCG
Edg-T3R12C7-EXT	CGTTTCCTTTGTTATCTAAAATATCTAAAGGAATTGAGGAAGTTTCCTTTCG
Edg-T3R14C7-EXT	CGTTTCCTTTACATCGCCATTAAAAAAACTGATAGCCCTAAATTTCCTTTCG
Edg-T3R16C7-EXT	CGTTTCCTTTTCGTCTGAAATGGATTACATTTGACGCTCAATTTCCTTTCG
Edg-T3R18C7-EXT	CGTTTCCTTTTTGATTAGTAATAACATTGTAGCAATACTTCTTTTCCTTTCG
Edg-T3R20C7-EXT	CGTTTCCTTTAGGAACGGTACGCCAGTAAAGGGATTTAGACTTTCCTTTCG
Edg-T4R00C7-EXT	CGTTTCCTTTGAGCACGTATAACGTGCTATGGTTGCTTTGACTTTCCTTTCG
Edg-T4R02C7-EXT	CGTTTCCTTTCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGTTTCCTTTCG
Edg-T4R04C7-EXT	CGTTTCCTTTATCACCCAAATCAAGTGCCCACTACGTGAACCTTTCCTTTCG
Edg-T4R06C7-EXT	CGTTTCCTTTATCCTGTTTGATGGTGGCCCCAGCAGGCGAAATTTCCTTTCG
Edg-T4R08C7-EXT	CGTTTCCTTTGCTCACTGCCCGCTTTACATTAATTGCGTTGCTTTCCTTTCG
Edg-T4R10C7-EXT	CGTTTCCTTTGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGTTTCCTTTCG
Edg-T4R12C7-EXT	CGTTTCCTTTCGTTGGTGTAGATGGGGTAATGGGATAGGTCATTTCCTTTCG
Edg-T4R14C7-EXT	CGTTTCCTTTTTTAAATTGTAAACGTATTGTATAAGCAAATATTTCCTTTCG
Edg-T4R16C7-EXT	CGTTTCCTTTGCCGGAGAGGGTAGCTTAGCTGATAAATTAATTTTCCTTTCG
Edg-T4R18C7-EXT	CGTTTCCTTTAAATTTTTAGAACCCTTTCAACGCAAGGATAATTTCCTTTCG
Edg-T4R20C7-EXT	CGTTTCCTTTTAAGCAATAAAGCCTCAAAGAATTAGCAAAATTTTCCTTTCG
Edg-EXT-helper	CGAAAGGAAAAAAGGAAACG

S11.5 Negation strands

Table S6: A full set of negation strands.

Name	Sequence
Neg-T1R00C7	TTTTCAGCTCGCGCCCTAGAATTGATGCCACC
Neg-T1R02C7	ATCAACTGTTATATGGGTTCGCAGAATTGGGA
Neg-T1R04C7	TAAAGGTACTCTCTAATATCAAAAGGAGCAAT
Neg-T1R06C7	TCATTCTCGTTTTCTGGATTTTTGATTTATGG
Neg-T1R08C7	TAATTCCTTTTGGCGTCTCTTACTATGCCTCG
Neg-T1R10C7	TCGTCAGGGCAAGCCTCTCGTTCTGGTGTTTC
Neg-T1R12C7	GCGATGATACAAATCTCGACACAATTTATCAG
Neg-T1R14C7	CGATGCTGTCTTTCGCGTTGCTACCCTCGTTC
Neg-T1R16C7	GATACAATTAAAGGCTAGCAAGCTGATAAACC
Neg-T1R18C7	ATACAGAAAATTCATTTGTTTAGCAAAATCCC
Neg-T1R20C7	ACTGGTGACGAAACTCAGGCGTTGTAGTTTGT
Neg-T2R00C7	CTGAGGGTGGCGGTTCAATGAGGGTGGTGGCT
Neg-T2R02C7	GACGGCACTTATCCGCTTATATCAACCCTCTC
Neg-T2R04C7	GGGCACTGTTACTCAACATTAACTGTTTATAC
Neg-T2R06C7	CTCAACCTCCTGTCAACAATCGTCTGACCTGC
Neg-T2R08C7	CAGTCTGACGCTAAAGCGATGAAAACGCGCTA
Neg-T2R10C7	TGGTAAACCATATGAACTTTTGTCTTTGGCGC
Neg-T2R12C7	TAAGATAGCTATTGCTTTAAAAAGGGCTTCGG
Neg-T2R14C7	TCGTTTCTTATTTGGAGACGTTAAACAAAAAA
Neg-T2R16C7	CGCTAAAACGCCTCGCCGCAAGTCGGGAGGTT
Neg-T2R18C7	ATACCCGTTCTTGGAATGCGGTACTTGGTTTA
Neg-T2R20C7	ATTGTTGATAAACAGGTGTTCAGGACTTATCT
Neg-T3R00C7	CTTTTGTCGGTACTTTGACAGAATTACTTTAC
Neg-T3R02C7	GTTGAGCGTTGGCTTTTCAATTAAGCCCTACT
Neg-T3R04C7	AAATTTAGGTCAGAAGGGTATTTCAAACCATT
Neg-T3R06C7	CTTCTCAGCGTCTTAAAAATTCACTATTGACT
Neg-T3R08C7	GGTAATTGAAATGAATCATCTTCTTTTGCTCA
Neg-T3R10C7	ATGAATTGCCATCATCAATCAGGATTATATTG
Neg-T3R12C7	CTTCCTCAATTCCTTTAGATATTTTAGATAAC
Neg-T3R14C7	TTTAGGGCTATCAGTTTTTTTAATGGCGATGT
Neg-T3R16C7	TTGAGCGTCAAAATGTAATCCATTTCAGACGA
Neg-T3R18C7	AGAAGTATTGCTACAATGTTATTACTAATCAA
Neg-T3R20C7	GTCTAAAATCCCTTTACTGGCGTACCGTTCCT
Neg-T4R00C7	GTCAAAGCAACCATAGCACGTTATACGTGCTC
Neg-T4R02C7	CTCCTTTCGCTTTCTTAGCGCCCTAGCGCCCG
Neg-T4R04C7	GGTTCACGTAGTGGGCACTTGATTTGGGTGAT
Neg-T4R06C7	TTTCGCCTGCTGGGGCCACCATCAAACAGGAT
Neg-T4R08C7	GCAACGCAATTAATGTAAAGCGGGCAGTGAGC
Neg-T4R10C7	CCAACTTAATCGCCTTAAAACCCTGGCGTTAC
Neg-T4R12C7	TGACCTATCCCATTACCCCATCTACACCAACG
Neg-T4R14C7	TATTTGCTTATACAATACGTTTACAATTTAAA
Neg-T4R16C7	ATTAATTTATCAGCTAAGCTACCCTCTCCGGC
Neg-T4R18C7	TTATCCTTGCGTTGAAAGGGTTCTAAAAATTT
Neg-T4R20C7	ATTTTGCTAATTCTTTGAGGCTTTATTGCTTA

S11.6 Edge staples with stacking bonds and sticky ends

Table S7: Edge staples that each have a stacking bond and a 1 nt sticky end.

Name	Sequence
Edg-1nt-Rec-T1C7R00	GGTGGCATCAATTCTAGGGCGCGAGCTGAAA
Edg-1nt-Rec-T1C7R02	TCCCAATTCTGCGAACCCATATAACAGTTGA
Edg-1nt-Rec-T1C7R04	ATTGCTCCTTTTGATATTAGAGAGTACCTTT
Edg-1nt-Rec-T1C7R06	CCATAAATCAAAAATCCAGAAAACGAGAATG
Edg-1nt-Rec-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAATT
Edg-1nt-Rec-T1C7R10	GAAACACCAGAACGAGAGGCTTGCCCTGACG
Edg-1nt-Rec-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATCG
Edg-1nt-Rec-T1C7R14	GAACGAGGGTAGCAACGCGAAAGACAGCATC
Edg-1nt-Rec-T1C7R16	GGTTTATCAGCTTGCTAGCCTTTAATTGTAT
Edg-1nt-Rec-T1C7R18	GGGATTTTGCTAAACAAATGAATTTTCTGTA
Edg-1nt-Rec-T1C7R20	ACAAACTACAACGCCTGAGTTTCGTCACCAG
Edg-1nt-Rec-T2C7R00	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-1nt-Rec-T2C7R02	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-1nt-Rec-T2C7R04	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-1nt-Rec-T2C7R06	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-1nt-Rec-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-1nt-Rec-T2C7R10	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-1nt-Rec-T2C7R12	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-1nt-Rec-T2C7R14	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-1nt-Rec-T2C7R16	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-1nt-Rec-T2C7R18	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-1nt-Rec-T2C7R20	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-1nt-Rec-T3C7R00	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-1nt-Rec-T3C7R02	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-1nt-Rec-T3C7R04	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-1nt-Rec-T3C7R06	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-1nt-Rec-T3C7R08	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-1nt-Rec-T3C7R10	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-1nt-Rec-T3C7R12	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-1nt-Rec-T3C7R14	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-1nt-Rec-T3C7R16	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-1nt-Rec-T3C7R18	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-1nt-Rec-T3C7R20	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-1nt-Rec-T4C7R00	GAGCACGTATAACGTGCTATGGTTGCTTTGA
Edg-1nt-Rec-T4C7R02	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGGA
Edg-1nt-Rec-T4C7R04	ATCACCCAAATCAAGTGCCCACTACGTGAAC
Edg-1nt-Rec-T4C7R06	ATCCTGTTTGATGGTGGCCCCAGCAGGCGAA
Edg-1nt-Rec-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTG
Edg-1nt-Rec-T4C7R10	GTAACGCCAGGGTTTTAAGGCGATTAAGTTG
Edg-1nt-Rec-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTC
Edg-1nt-Rec-T4C7R14	TTTAAATTGTAAACGTATTGTATAAGCAAAT
Edg-1nt-Rec-T4C7R16	GCCGGAGAGGGTAGCTTAGCTGATAAATTAA
Edg-1nt-Rec-T4C7R18	AAATTTTTAGAACCCTTTCAACGCAAGGATA
Edg-1nt-Rec-T4C7R20	TAAGCAATAAAGCCTCAAAGAATTAGCAAAA
Edg-1nt-G1-T1C7R00	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-1nt-G1-T1C7R02	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-1nt-G1-T1C7R04	CATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-1nt-G1-T1C7R06	GCCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-1nt-G1-T1C7R08	CCGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-1nt-G1-T1C7R10	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA

Name	Sequence
Edg-1nt-G1-T1C7R12	ACTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-1nt-G1-T1C7R14	AGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-1nt-G1-T1C7R16	AGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-1nt-G1-T1C7R18	TGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-1nt-G1-T1C7R20	AACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-1nt-G1-T3C7R02	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-1nt-G1-T3C7R06	GAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-1nt-G1-T3C7R10	ACAATATAATCCTGATTGATGATGGCAATTCAT
Edg-1nt-G1-T3C7R14	AACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-1nt-G1-T3C7R18	TTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-1nt-G1-T4C7R00	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-1nt-G1-T4C7R02	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-1nt-G1-T4C7R04	CATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-1nt-G1-T4C7R06	GATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-1nt-G1-T4C7R08	CGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-1nt-G1-T4C7R10	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-1nt-G1-T4C7R12	ACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-1nt-G1-T4C7R14	ATTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-1nt-G1-T4C7R16	AGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-1nt-G1-T4C7R18	TAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-1nt-G1-T4C7R20	ATAAGCAATAAAGCCTCAAAGAATTAGCAAAAT
Edg-1nt-G2-T1C7R00	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-1nt-G2-T1C7R02	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-1nt-G2-T1C7R04	GATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-1nt-G2-T1C7R06	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-1nt-G2-T1C7R08	ACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-1nt-G2-T1C7R10	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-1nt-G2-T1C7R12	GCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-1nt-G2-T1C7R14	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-1nt-G2-T1C7R16	CGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-1nt-G2-T1C7R18	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-1nt-G2-T1C7R20	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-1nt-G2-T2C7R00	TAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-1nt-G2-T2C7R02	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-1nt-G2-T2C7R04	GGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-1nt-G2-T2C7R06	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-1nt-G2-T2C7R08	ATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-1nt-G2-T2C7R10	AGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-1nt-G2-T2C7R12	GCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-1nt-G2-T2C7R14	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-1nt-G2-T2C7R16	CAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-1nt-G2-T2C7R18	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-1nt-G2-T2C7R20	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-1nt-G2-T3C7R00	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-1nt-G2-T3C7R02	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-1nt-G2-T3C7R04	GAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-1nt-G2-T3C7R06	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-1nt-G2-T3C7R08	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-1nt-G2-T3C7R10	ACAATATAATCCTGATTGATGATGGCAATTCAT
Edg-1nt-G2-T3C7R12	GGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-1nt-G2-T3C7R14	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-1nt-G2-T3C7R16	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-1nt-G2-T3C7R18	CTTGATTAGTAATAACATTGTAGCAATACTTCT

Name	Sequence
Edg-1nt-G2-T3C7R20	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-1nt-G2-T4C7R00	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-1nt-G2-T4C7R02	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-1nt-G2-T4C7R04	GATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-1nt-G2-T4C7R06	AATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-1nt-G2-T4C7R08	AGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-1nt-G2-T4C7R10	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-1nt-G2-T4C7R12	GCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-1nt-G2-T4C7R14	GTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-1nt-G2-T4C7R16	CGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-1nt-G2-T4C7R18	CAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-1nt-G2-T4C7R20	GTAAGCAATAAAGCCTCAAAGAATTAGCAAAAT
Edg-1nt-G3-T1C7R00	CGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-1nt-G3-T1C7R02	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-1nt-G3-T1C7R04	AATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-1nt-G3-T1C7R06	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-1nt-G3-T1C7R08	GCGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-1nt-G3-T1C7R10	TGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-1nt-G3-T1C7R12	CCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-1nt-G3-T1C7R14	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-1nt-G3-T1C7R16	TGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-1nt-G3-T1C7R18	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-1nt-G3-T1C7R20	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-1nt-G3-T2C7R00	CAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-1nt-G3-T2C7R02	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-1nt-G3-T2C7R04	AGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-1nt-G3-T2C7R06	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-1nt-G3-T2C7R08	GTAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-1nt-G3-T2C7R10	TGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-1nt-G3-T2C7R12	CCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-1nt-G3-T2C7R14	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-1nt-G3-T2C7R16	TAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-1nt-G3-T2C7R18	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-1nt-G3-T2C7R20	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-1nt-G3-T3C7R00	CGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-1nt-G3-T3C7R02	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-1nt-G3-T3C7R04	AAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-1nt-G3-T3C7R06	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-1nt-G3-T3C7R08	GTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-1nt-G3-T3C7R10	TCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-1nt-G3-T3C7R12	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-1nt-G3-T3C7R14	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-1nt-G3-T3C7R16	TTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-1nt-G3-T3C7R18	CTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-1nt-G3-T3C7R20	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-1nt-G3-T4C7R00	CGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-1nt-G3-T4C7R02	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-1nt-G3-T4C7R04	AATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-1nt-G3-T4C7R06	AATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-1nt-G3-T4C7R08	GGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-1nt-G3-T4C7R10	TGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-1nt-G3-T4C7R12	CCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-1nt-G3-T4C7R14	GTTTAAATTGTAAACGTATTGTATAAGCAAATA

Name	Sequence
Edg-1nt-G3-T4C7R16	TGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-1nt-G3-T4C7R18	CAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-1nt-G3-T4C7R20	GTAAGCAATAAAGCCTCAAAGAATTAGCAAAAT
Edg-1nt-G4-T3C7R00	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-1nt-G4-T3C7R02	AAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-1nt-G4-T3C7R04	TAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-1nt-G4-T3C7R06	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-1nt-G4-T3C7R08	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-1nt-G4-T3C7R10	GCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-1nt-G4-T3C7R12	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-1nt-G4-T3C7R14	AACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-1nt-G4-T3C7R16	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-1nt-G4-T3C7R18	GTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-1nt-G4-T3C7R20	CAGGAACGGTACGCCAGTAAAGGGATTTTAGAC

Table S8: Edge staples that each have a stacking bond and a 2 nt sticky end.

Name	Sequence
Edg-2nt-Rec-T1C7R02	TCCCAATTCTGCGAACCCATATAACAGTTG
Edg-2nt-Rec-T1C7R04	ATTGCTCCTTTTGATATTAGAGAGTACCTT
Edg-2nt-Rec-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAAT
Edg-2nt-Rec-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATC
Edg-2nt-Rec-T1C7R16	GGTTTATCAGCTTGCTAGCCTTTAATTGTA
Edg-2nt-Rec-T2C7R02	GAGAGGGTTGATATAAGCGGATAAGTGCCG
Edg-2nt-Rec-T2C7R04	GTATAAACAGTTAATGTTGAGTAACAGTGC
Edg-2nt-Rec-T2C7R06	GCAGGTCAGACGATTGTTGACAGGAGGTTG
Edg-2nt-Rec-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCAGAC
Edg-2nt-Rec-T2C7R12	CCGAAGCCCTTTTTAAAGCAATAGCTATCT
Edg-2nt-Rec-T2C7R14	TTTTTGTTTAACGTCTCCAAATAAGAAAC
Edg-2nt-Rec-T2C7R16	AACCTCCCGACTTGCGGCGAGGCGTTTTAG
Edg-2nt-Rec-T2C7R18	TAAACCAAGTACCGCATTCCAAGAACGGGT
Edg-2nt-Rec-T3C7R02	AGTAGGGCTTAATTGAAAAGCCAACGCTCA
Edg-2nt-Rec-T3C7R04	AATGGTTTGAAATACCCTTCTGACCTAAAT
Edg-2nt-Rec-T3C7R06	AGTCAATAGTGAATTTTTAAGACGCTGAGA
Edg-2nt-Rec-T3C7R08	TGAGCAAAAGAAGATGATTCATTTCAATTA
Edg-2nt-Rec-T3C7R12	GTTATCTAAAATATCTAAAGGAATTGAGGA
Edg-2nt-Rec-T3C7R14	ACATCGCCATTAAAAAAACTGATAGCCCTA
Edg-2nt-Rec-T3C7R16	TCGTCTGAAATGGATTACATTTTGACGCTC
Edg-2nt-Rec-T3C7R18	TTGATTAGTAATAACATTGTAGCAATACTT
Edg-2nt-Rec-T4C7R02	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGG
Edg-2nt-Rec-T4C7R04	ATCACCCAAATCAAGTGCCCACTACGTGAA
Edg-2nt-Rec-T4C7R06	ATCCTGTTTGATGGTGGCCCCAGCAGGCGA
Edg-2nt-Rec-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTT
Edg-2nt-Rec-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGT
Edg-2nt-Rec-T4C7R14	TTTAAATTGTAAACGTATTGTATAAGCAAA
Edg-2nt-Rec-T4C7R16	GCCGGAGAGGGTAGCTTAGCTGATAAATTA
Edg-2nt-Rec-T4C7R18	AAATTTTTAGAACCCTTTCAACGCAAGGAT
Edg-2nt-G1-T4C7R04	TCATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-2nt-G1-T4C7R08	GCGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-2nt-G1-T4C7R12	TACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-2nt-G1-T4C7R16	TAGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-2nt-G1-T4C7R18	ATAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-2nt-G2-T1C7R02	ATTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-2nt-G2-T1C7R04	CGATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-2nt-G2-T1C7R06	GACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-2nt-G2-T1C7R08	TACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-2nt-G2-T1C7R12	TGCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-2nt-G2-T1C7R14	AGGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-2nt-G2-T1C7R16	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-2nt-G2-T1C7R18	TCGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-2nt-G2-T2C7R02	ATGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-2nt-G2-T2C7R04	CGGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-2nt-G2-T2C7R06	GAGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-2nt-G2-T2C7R08	TATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-2nt-G2-T2C7R12	TGCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-2nt-G2-T2C7R14	AGTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-2nt-G2-T2C7R16	CCAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-2nt-G2-T2C7R18	TCTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-2nt-G2-T3C7R02	ATAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-2nt-G2-T3C7R04	CGAATGGTTTGAAATACCCTTCTGACCTAAATTT

Name	Sequence
Edg-2nt-G2-T3C7R06	GAAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-2nt-G2-T3C7R08	TATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-2nt-G2-T3C7R12	TGGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-2nt-G2-T3C7R14	AGACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-2nt-G2-T3C7R16	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-2nt-G2-T3C7R18	TCTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-2nt-G2-T4C7R02	ATCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-2nt-G2-T4C7R04	CGATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-2nt-G2-T4C7R06	GAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-2nt-G2-T4C7R08	TAGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-2nt-G2-T4C7R12	TGCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-2nt-G2-T4C7R14	AGTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-2nt-G2-T4C7R16	CCGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-2nt-G2-T4C7R18	TCAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-2nt-G3-T2C7R04	AAGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-2nt-G3-T2C7R08	AGTAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-2nt-G3-T2C7R12	CCCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-2nt-G3-T2C7R16	TTAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-2nt-G3-T3C7R04	AAAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-2nt-G3-T3C7R08	AGTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-2nt-G3-T3C7R12	CCGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-2nt-G3-T3C7R16	TTTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-2nt-G3-T4C7R02	CTCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-2nt-G3-T4C7R06	AAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-2nt-G3-T4C7R14	AGTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-2nt-G3-T4C7R18	ACAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-2nt-G4-T1C7R02	AATCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-2nt-G4-T1C7R04	ATATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-2nt-G4-T1C7R06	TACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-2nt-G4-T1C7R08	CACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-2nt-G4-T1C7R12	GCCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-2nt-G4-T1C7R14	AAGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-2nt-G4-T1C7R16	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-2nt-G4-T1C7R18	AGGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-2nt-G4-T2C7R02	AAGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-2nt-G4-T2C7R04	ATGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-2nt-G4-T2C7R06	TAGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-2nt-G4-T2C7R08	CATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-2nt-G4-T2C7R12	GCCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-2nt-G4-T2C7R14	AATTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-2nt-G4-T2C7R16	CCAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-2nt-G4-T2C7R18	AGTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-2nt-G4-T3C7R04	ATAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-2nt-G4-T3C7R08	CATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-2nt-G4-T3C7R12	GCGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-2nt-G4-T3C7R16	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA

Table S9: Edge staples that each have a stacking bond and a 4 nt sticky end.

Name	Sequence
Edg-4nt-Rec-T1C7R06	CCATAAATCAAAAATCCAGAAAACGAGA
Edg-4nt-Rec-T1C7R14	GAACGAGGGTAGCAACGCGAAAGACAGC
Edg-4nt-Rec-T2C7R06	GCAGGTCAGACGATTGTTGACAGGAGGT
Edg-4nt-Rec-T2C7R14	TTTTTTGTTTAACGTCTCCAAATAAGAA
Edg-4nt-G1-T3C7R06	ATCGAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-4nt-G1-T3C7R14	ATGAACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-4nt-G2-T4C7R06	ACGAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-4nt-G2-T4C7R14	TGAGTTTAAATTGTAAACGTATTGTATAAGCAAATA

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S11.7 Edge staples for measuring the melting temperature

Table S10: Edge staples for measuring the melting temperature (Fig. S22).

Name	Sequence
Edg-2nt-Rec-T1C7R02	TCCCAATTCTGCGAACCCATATAACAGTTG
Edg-F-T1R04	ATTGCTCCTTTTGATATTAGAGAGTACCTT/3Rox-N/
Edg-2nt-Rec-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAAT
Edg-2nt-Rec-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATC
Edg-2nt-Rec-T1C7R16	GGTTTATCAGCTTGCTAGCCTTTAATTGTA
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-2nt-G1-T4C7R04	TCATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-2nt-G1-T4C7R08	GCGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-2nt-G1-T4C7R12	TACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-Q-T4R17	/5IAbRQ/CGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-2nt-G1-T4C7R18	ATAAATTTTTAGAACCCTTTCAACGCAAGGATAA

S11.8 Edge staples in most unbounded arrays

Table S11: Edge staples in most unbounded arrays
(Figs. 2 to 5, S17 to S20, S27, S28, S31 to S35, S38 to S40, S43 to S46).

Name	Sequence
Edg-T1C7R04-2nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTT
Edg-T1C7R08-2nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAAT
Edg-T1C7R12-2nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATC
Edg-T1C7R16-2nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTA
Edg-T2C7R04-2nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGC
Edg-T2C7R08-2nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGAC
Edg-T2C7R12-2nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCT
Edg-T2C7R16-2nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAG
Edg-T3C7R04-2nt-G2	CGAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R08-2nt-G2	TATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-2nt-G2	TGGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R16-2nt-G2	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T4C7R04-2nt-G1	TCATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R08-2nt-G1	GCGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12-2nt-G1	TACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R16-2nt-G1	TAGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT

S11.9 Edge staples in fully-connected 3 by 3 arrays

Table S12: Edge staples of Tile 1 in the fully-connected 3 by 3 arrays (Fig. S51).

Name	Sequence
Edg-T1C7R00-1nt-G2	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G2	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G2	GATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G2	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G2	ACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G2	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G2	GCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G2	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G2	CGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G2	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G2	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2C7R00-1nt-G2	TAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2C7R02-1nt-G2	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-1nt-G2	GGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-1nt-G2	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-1nt-G2	ATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R10-1nt-G2	AGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2C7R12-1nt-G2	GCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-1nt-G2	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-1nt-G2	CAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-1nt-G2	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2C7R20-1nt-G2	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3C7R00-1nt-G2	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G2	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G2	GAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G2	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G2	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G2	ACAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G2	GGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G2	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G2	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G2	CTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G2	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R00-1nt-G2	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4C7R02-1nt-G2	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-1nt-G2	GATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-1nt-G2	AATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-1nt-G2	AGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R10-1nt-G2	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4C7R12-1nt-G2	GCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-1nt-G2	GTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-1nt-G2	CGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-1nt-G2	CAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4C7R20-1nt-G2	GTAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

Table S13: Edge staples of Tile 2 in the fully-connected 3 by 3 arrays (Fig. S51).

Name	Sequence
Edg-T1C7R00-1nt-Rec	GGTGGCATCAATTCTAGGGCGCGAGCTGAAA
Edg-T1C7R02-1nt-Rec	TCCCAATTCTGCGAACCCATATAACAGTTGA
Edg-T1C7R04-1nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTTT
Edg-T1C7R06-1nt-Rec	CCATAAATCAAAAATCCAGAAAACGAGAATG
Edg-T1C7R08-1nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAATT
Edg-T1C7R10-1nt-Rec	GAAACACCAGAACGAGAGGCTTGCCCTGACG
Edg-T1C7R12-1nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATCG
Edg-T1C7R14-1nt-Rec	GAACGAGGGTAGCAACGCGAAAGACAGCATC
Edg-T1C7R16-1nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTAT
Edg-T1C7R18-1nt-Rec	GGGATTTTGCTAAACAAATGAATTTTCTGTA
Edg-T1C7R20-1nt-Rec	ACAAACTACAACGCCTGAGTTTCGTCACCAG
Edg-T2C7R00-1nt-Rec	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-T2C7R02-1nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-T2C7R04-1nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-T2C7R06-1nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-T2C7R08-1nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-T2C7R10-1nt-Rec	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-T2C7R12-1nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-T2C7R14-1nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-T2C7R16-1nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-T2C7R18-1nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-T2C7R20-1nt-Rec	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-T3C7R00-1nt-Rec	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-T3C7R02-1nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-T3C7R04-1nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-T3C7R06-1nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-T3C7R08-1nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-T3C7R10-1nt-Rec	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-T3C7R12-1nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-T3C7R14-1nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-T3C7R16-1nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-T3C7R18-1nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-T3C7R20-1nt-Rec	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-T4R00C7-DHP	GTGTCGTAGACACGAGCACGTATAACGTGCTATGGTTGCTTTGACGTGTCGTAGACAC
Edg-T4R02C7-DHP	GTGTCGTAGACACCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGGTGTCGTAGACAC
Edg-T4R04C7-DHP	GTGTCGTAGACACATCACCCAAATCAAGTGCCCACTACGTGAACCGTGTCGTAGACAC
Edg-T4R06C7-DHP	GTGTCGTAGACACATCCTGTTTGATGGTGGCCCCAGCAGGCGAAAGTGTCGTAGACAC
Edg-T4R08C7-DHP	GTGTCGTAGACACGCTCACTGCCCGCTTTACATTAATTGCGTTGCGTGTCGTAGACAC
Edg-T4R10C7-DHP	GTGTCGTAGACACGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGGTGTCGTAGACAC
Edg-T4R12C7-DHP	GTGTCGTAGACACCGTTGGTGTAGATGGGGTAATGGGATAGGTCAGTGTCGTAGACAC
Edg-T4R14C7-DHP	GTGTCGTAGACACTTTAAATTGTAAACGTATTGTATAAGCAAATAGTGTCGTAGACAC
Edg-T4R16C7-DHP	GTGTCGTAGACACGCCGGAGAGGGTAGCTTAGCTGATAAATTAATGTGTCGTAGACAC
Edg-T4R18C7-DHP	GTGTCGTAGACACAAATTTTTAGAACCCTTTCAACGCAAGGATAAGTGTCGTAGACAC
Edg-T4R20C7-DHP	GTGTCGTAGACACTAAGCAATAAAGCCTCAAAGAATTAGCAAAATGTGTCGTAGACAC

Table S14: Edge staples of Tile 3 in the fully-connected 3 by 3 arrays (Fig. S51).

Name	Sequence
Edg-T1C7R00-1nt-G1	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G1	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G1	CATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G1	GCCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G1	CCGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G1	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G1	ACTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G1	AGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G1	AGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G1	TGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G1	AACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R00-1nt-G3	CGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4C7R02-1nt-G3	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-1nt-G3	AATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-1nt-G3	AATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-1nt-G3	GGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R10-1nt-G3	TGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4C7R12-1nt-G3	CCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-1nt-G3	GTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-1nt-G3	TGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-1nt-G3	CAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4C7R20-1nt-G3	GTAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

S11.10 Edge staples in fully-connected 4 by 4 arrays

Table S15: Edge staples of Tile 1 in the fully-connected 4 by 4 arrays (Fig. S52).

Name	Sequence
Edg-T1C7R00-1nt-G2	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G2	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G2	GATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G2	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G2	ACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G2	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G2	GCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G2	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G2	CGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G2	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G2	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2C7R00-1nt-G3	CAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2C7R02-1nt-G3	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-1nt-G3	AGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-1nt-G3	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-1nt-G3	GTAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R10-1nt-G3	TGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2C7R12-1nt-G3	CCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-1nt-G3	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-1nt-G3	TAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-1nt-G3	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2C7R20-1nt-G3	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3C7R04-2nt-G4	ATAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R08-2nt-G4	CATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-2nt-G4	GCGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R16-2nt-G4	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T4C7R04-2nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAA
Edg-T4C7R08-2nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTT
Edg-T4C7R12-2nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGT
Edg-T4C7R16-2nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTA

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Table S16: Edge staples of Tile 2 in the fully-connected 4 by 4 arrays (Fig. S52).

Name	Sequence
Edg-T1C7R00-1nt-Rec	GGTGGCATCAATTCTAGGGCGCGAGCTGAAA
Edg-T1C7R02-1nt-Rec	TCCCAATTCTGCGAACCCATATAACAGTTGA
Edg-T1C7R04-1nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTTT
Edg-T1C7R06-1nt-Rec	CCATAAATCAAAAATCCAGAAAACGAGAATG
Edg-T1C7R08-1nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAATT
Edg-T1C7R10-1nt-Rec	GAAACACCAGAACGAGAGGCTTGCCCTGACG
Edg-T1C7R12-1nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATCG
Edg-T1C7R14-1nt-Rec	GAACGAGGGTAGCAACGCGAAAGACAGCATC
Edg-T1C7R16-1nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTAT
Edg-T1C7R18-1nt-Rec	GGGATTTTGCTAAACAAATGAATTTTCTGTA
Edg-T1C7R20-1nt-Rec	ACAAACTACAACGCCTGAGTTTCGTCACCAG
Edg-T2C7R00-1nt-Rec	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-T2C7R02-1nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-T2C7R04-1nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-T2C7R06-1nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-T2C7R08-1nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-T2C7R10-1nt-Rec	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-T2C7R12-1nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-T2C7R14-1nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-T2C7R16-1nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-T2C7R18-1nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-T2C7R20-1nt-Rec	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-T3C7R04-2nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAAT
Edg-T3C7R08-2nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTA
Edg-T3C7R12-2nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGA
Edg-T3C7R16-2nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTC
Edg-T4R00C7-DHP	GTGTCGTAGACACGAGCACGTATAACGTGCTATGGTTGCTTTGACGTGTCGTAGACAC
Edg-T4R02C7-DHP	GTGTCGTAGACACCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGGTGTCGTAGACAC
Edg-T4R04C7-DHP	GTGTCGTAGACACATCACCCAAATCAAGTGCCCACTACGTGAACCGTGTCGTAGACAC
Edg-T4R06C7-DHP	GTGTCGTAGACACATCCTGTTTGATGGTGGCCCCAGCAGGCGAAAGTGTCGTAGACAC
Edg-T4R08C7-DHP	GTGTCGTAGACACGCTCACTGCCCGCTTTACATTAATTGCGTTGCGTGTCGTAGACAC
Edg-T4R10C7-DHP	GTGTCGTAGACACGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGGTGTCGTAGACAC
Edg-T4R12C7-DHP	GTGTCGTAGACACCGTTGGTGTAGATGGGGTAATGGGATAGGTCAGTGTCGTAGACAC
Edg-T4R14C7-DHP	GTGTCGTAGACACTTTAAATTGTAAACGTATTGTATAAGCAAATAGTGTCGTAGACAC
Edg-T4R16C7-DHP	GTGTCGTAGACACGCCGGAGAGGGTAGCTTAGCTGATAAATTAATGTGTCGTAGACAC
Edg-T4R18C7-DHP	GTGTCGTAGACACAAATTTTTAGAACCCTTTCAACGCAAGGATAAGTGTCGTAGACAC
Edg-T4R20C7-DHP	GTGTCGTAGACACTAAGCAATAAAGCCTCAAAGAATTAGCAAAATGTGTCGTAGACAC

Table S17: Edge staples of Tile 3 in the fully-connected 4 by 4 arrays (Fig. S52).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2C7R04-2nt-G3	AAGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R08-2nt-G3	AGTAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12-2nt-G3	CCCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R16-2nt-G3	TTAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T3C7R00-1nt-Rec	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-T3C7R02-1nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-T3C7R04-1nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-T3C7R06-1nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-T3C7R08-1nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-T3C7R10-1nt-Rec	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-T3C7R12-1nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-T3C7R14-1nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-T3C7R16-1nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-T3C7R18-1nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-T3C7R20-1nt-Rec	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-T4C7R00-1nt-Rec	GAGCACGTATAACGTGCTATGGTTGCTTTGA
Edg-T4C7R02-1nt-Rec	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGGA
Edg-T4C7R04-1nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAAC
Edg-T4C7R06-1nt-Rec	ATCCTGTTTGATGGTGGCCCCAGCAGGCGAA
Edg-T4C7R08-1nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTTG
Edg-T4C7R10-1nt-Rec	GTAACGCCAGGGTTTTAAGGCGATTAAGTTG
Edg-T4C7R12-1nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGTC
Edg-T4C7R14-1nt-Rec	TTTAAATTGTAAACGTATTGTATAAGCAAAT
Edg-T4C7R16-1nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTAA
Edg-T4C7R18-1nt-Rec	AAATTTTTAGAACCCTTTCAACGCAAGGATA
Edg-T4C7R20-1nt-Rec	TAAGCAATAAAGCCTCAAAGAATTAGCAAAA

Table S18: Edge staples of Tile 4 in the fully-connected 4 by 4 arrays (Fig. S52).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3C7R00-1nt-G4	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G4	AAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G4	TAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G4	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G4	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G4	GCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G4	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G4	AACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G4	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G4	GTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G4	CAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R00-1nt-G1	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4C7R02-1nt-G1	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-1nt-G1	CATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-1nt-G1	GATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-1nt-G1	CGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R10-1nt-G1	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4C7R12-1nt-G1	ACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-1nt-G1	ATTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-1nt-G1	AGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-1nt-G1	TAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4C7R20-1nt-G1	ATAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

S11.11 Edge staples in fully-connected 5 by 5 arrays

Table S19: Edge staples of Tile 1 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1C7R02-2nt-G2	ATTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-2nt-G2	CGATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-2nt-G2	GACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-2nt-G2	TACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12-2nt-G2	TGCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-2nt-G2	AGGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-2nt-G2	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-2nt-G2	TCGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T2C7R02-2nt-G2	ATGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-2nt-G2	CGGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-2nt-G2	GAGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-2nt-G2	TATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12-2nt-G2	TGCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-2nt-G2	AGTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-2nt-G2	CCAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-2nt-G2	TCTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T3C7R02-2nt-G2	ATAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-2nt-G2	CGAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-2nt-G2	GAAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-2nt-G2	TATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-2nt-G2	TGGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-2nt-G2	AGACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-2nt-G2	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-2nt-G2	TCTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T4C7R02-2nt-G2	ATCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-2nt-G2	CGATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-2nt-G2	GAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-2nt-G2	TAGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12-2nt-G2	TGCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-2nt-G2	AGTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-2nt-G2	CCGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-2nt-G2	TCAAATTTTTAGAACCCTTTCAACGCAAGGATAA

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Table S20: Edge staples of Tile 2 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1C7R04-2nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTT
Edg-T1C7R08-2nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAAT
Edg-T1C7R12-2nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATC
Edg-T1C7R16-2nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTA
Edg-T2C7R02-2nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCG
Edg-T2C7R04-2nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGC
Edg-T2C7R06-2nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTG
Edg-T2C7R08-2nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGAC
Edg-T2C7R12-2nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCT
Edg-T2C7R14-2nt-Rec	TTTTTGTTTAACGTCTCCAAATAAGAAAC
Edg-T2C7R16-2nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAG
Edg-T2C7R18-2nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGT
Edg-T3C7R04-2nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAAT
Edg-T3C7R08-2nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTA
Edg-T3C7R12-2nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGA
Edg-T3C7R16-2nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTC
Edg-T4C7R02-2nt-Rec	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGG
Edg-T4C7R04-2nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAA
Edg-T4C7R06-2nt-Rec	ATCCTGTTTGATGGTGGCCCCAGCAGGCGA
Edg-T4C7R08-2nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTT
Edg-T4C7R12-2nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGT
Edg-T4C7R14-2nt-Rec	TTTAAATTGTAAACGTATTGTATAAGCAAA
Edg-T4C7R16-2nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTA
Edg-T4C7R18-2nt-Rec	AAATTTTTAGAACCCTTTCAACGCAAGGAT

Table S21: Edge staples of Tile 3 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1C7R00-1nt-G2	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G2	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G2	GATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G2	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G2	ACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G2	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G2	GCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G2	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G2	CGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G2	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G2	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2C7R00-1nt-G3	CAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2C7R02-1nt-G3	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-1nt-G3	AGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-1nt-G3	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-1nt-G3	GTAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R10-1nt-G3	TGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2C7R12-1nt-G3	CCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-1nt-G3	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-1nt-G3	TAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-1nt-G3	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2C7R20-1nt-G3	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3C7R04-2nt-G3	AAAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R08-2nt-G3	AGTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-2nt-G3	CCGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R16-2nt-G3	TTTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T4C7R04-2nt-G1	TCATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R08-2nt-G1	GCGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12-2nt-G1	TACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R16-2nt-G1	TAGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT

Table S22: Edge staples of Tile 4 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1C7R00-1nt-Rec	GGTGGCATCAATTCTAGGGCGCGAGCTGAAA
Edg-T1C7R02-1nt-Rec	TCCCAATTCTGCGAACCCATATAACAGTTGA
Edg-T1C7R04-1nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTTT
Edg-T1C7R06-1nt-Rec	CCATAAATCAAAAATCCAGAAAACGAGAATG
Edg-T1C7R08-1nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAATT
Edg-T1C7R10-1nt-Rec	GAAACACCAGAACGAGAGGCTTGCCCTGACG
Edg-T1C7R12-1nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATCG
Edg-T1C7R14-1nt-Rec	GAACGAGGGTAGCAACGCGAAAGACAGCATC
Edg-T1C7R16-1nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTAT
Edg-T1C7R18-1nt-Rec	GGGATTTTGCTAAACAAATGAATTTTCTGTA
Edg-T1C7R20-1nt-Rec	ACAAACTACAACGCCTGAGTTTCGTCACCAG
Edg-T2C7R00-1nt-Rec	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-T2C7R02-1nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-T2C7R04-1nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-T2C7R06-1nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-T2C7R08-1nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-T2C7R10-1nt-Rec	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-T2C7R12-1nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-T2C7R14-1nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-T2C7R16-1nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-T2C7R18-1nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-T2C7R20-1nt-Rec	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-T3C7R02-2nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCA
Edg-T3C7R06-2nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGA
Edg-T3C7R14-2nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTA
Edg-T3C7R18-2nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTT
Edg-T4R00C7-DHP	GTGTCGTAGACACGAGCACGTATAACGTGCTATGGTTGCTTTGACGTGTCGTAGACAC
Edg-T4R02C7-DHP	GTGTCGTAGACACCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGGTGTCGTAGACAC
Edg-T4R04C7-DHP	GTGTCGTAGACACATCACCCAAATCAAGTGCCCACTACGTGAACCGTGTCGTAGACAC
Edg-T4R06C7-DHP	GTGTCGTAGACACATCCTGTTTGATGGTGGCCCCAGCAGGCGAAAGTGTCGTAGACAC
Edg-T4R08C7-DHP	GTGTCGTAGACACGCTCACTGCCCGCTTTACATTAATTGCGTTGCGTGTCGTAGACAC
Edg-T4R10C7-DHP	GTGTCGTAGACACGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGGTGTCGTAGACAC
Edg-T4R12C7-DHP	GTGTCGTAGACACCGTTGGTGTAGATGGGGTAATGGGATAGGTCAGTGTCGTAGACAC
Edg-T4R14C7-DHP	GTGTCGTAGACACTTTAAATTGTAAACGTATTGTATAAGCAAATAGTGTCGTAGACAC
Edg-T4R16C7-DHP	GTGTCGTAGACACGCCGGAGAGGGTAGCTTAGCTGATAAATTAATGTGTCGTAGACAC
Edg-T4R18C7-DHP	GTGTCGTAGACACAAATTTTTAGAACCCTTTCAACGCAAGGATAAGTGTCGTAGACAC
Edg-T4R20C7-DHP	GTGTCGTAGACACTAAGCAATAAAGCCTCAAAGAATTAGCAAAATGTGTCGTAGACAC

Table S23: Edge staples of Tile 5 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1C7R02-2nt-G4	AATCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-2nt-G4	ATATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-2nt-G4	TACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-2nt-G4	CACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12-2nt-G4	GCCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-2nt-G4	AAGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-2nt-G4	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-2nt-G4	AGGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T2C7R02-2nt-G2	ATGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R06-2nt-G2	GAGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R14-2nt-G2	AGTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R18-2nt-G2	TCTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R02-2nt-G3	CTCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R06-2nt-G3	AAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R14-2nt-G3	AGTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R18-2nt-G3	ACAAATTTTTAGAACCCTTTCAACGCAAGGATAA

Table S24: Edge staples of Tile 6 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2C7R02-2nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCG
Edg-T2C7R06-2nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTG
Edg-T2C7R14-2nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAAC
Edg-T2C7R18-2nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGT
Edg-T3C7R00-1nt-Rec	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-T3C7R02-1nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-T3C7R04-1nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-T3C7R06-1nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-T3C7R08-1nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-T3C7R10-1nt-Rec	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-T3C7R12-1nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-T3C7R14-1nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-T3C7R16-1nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-T3C7R18-1nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-T3C7R20-1nt-Rec	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-T4C7R00-1nt-Rec	GAGCACGTATAACGTGCTATGGTTGCTTTGA
Edg-T4C7R02-1nt-Rec	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGGA
Edg-T4C7R04-1nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAAC
Edg-T4C7R06-1nt-Rec	ATCCTGTTTGATGGTGGCCCCAGCAGGCGAA
Edg-T4C7R08-1nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTTG
Edg-T4C7R10-1nt-Rec	GTAACGCCAGGGTTTTAAGGCGATTAAGTTG
Edg-T4C7R12-1nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGTC
Edg-T4C7R14-1nt-Rec	TTTAAATTGTAAACGTATTGTATAAGCAAAT
Edg-T4C7R16-1nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTAA
Edg-T4C7R18-1nt-Rec	AAATTTTTAGAACCCTTTCAACGCAAGGATA
Edg-T4C7R20-1nt-Rec	TAAGCAATAAAGCCTCAAAGAATTAGCAAAA

Table S25: Edge staples of Tile 7 in the fully-connected 5 by 5 arrays (Fig. S53).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3C7R00-1nt-G4	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G4	AAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G4	TAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G4	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G4	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G4	GCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G4	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G4	AACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G4	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G4	GTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G4	CAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R00-1nt-G1	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4C7R02-1nt-G1	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-1nt-G1	CATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-1nt-G1	GATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-1nt-G1	CGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R10-1nt-G1	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4C7R12-1nt-G1	ACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-1nt-G1	ATTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-1nt-G1	AGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-1nt-G1	TAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4C7R20-1nt-G1	ATAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

S11.12 Edge staples in comb-connected 3 by 3 arrays

Table S26: Edge staples of Tile 1 in the comb-connected 3 by 3 arrays (Fig. S54).

Name	Sequence
Edg-T1C7R00-1nt-G2	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G2	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G2	GATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G2	ACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G2	ACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G2	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G2	GCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G2	GGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G2	CGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G2	CGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G2	GACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2C7R00-1nt-G2	TAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2C7R02-1nt-G2	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-1nt-G2	GGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-1nt-G2	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-1nt-G2	ATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R10-1nt-G2	AGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2C7R12-1nt-G2	GCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-1nt-G2	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-1nt-G2	CAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-1nt-G2	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2C7R20-1nt-G2	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3C7R00-1nt-G2	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G2	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G2	GAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G2	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G2	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G2	ACAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G2	GGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G2	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G2	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G2	CTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G2	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R00-1nt-G2	TGAGCACGTATAACGTGCTATGGTTGCTTTGAC
Edg-T4C7R02-1nt-G2	TCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-1nt-G2	GATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-1nt-G2	AATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-1nt-G2	AGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R10-1nt-G2	AGTAACGCCAGGGTTTTAAGGCGATTAAGTTGG
Edg-T4C7R12-1nt-G2	GCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-1nt-G2	GTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-1nt-G2	CGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-1nt-G2	CAAATTTTTAGAACCCTTTCAACGCAAGGATAA
Edg-T4C7R20-1nt-G2	GTAAGCAATAAAGCCTCAAAGAATTAGCAAAAT

Table S27: Edge staples of Tile 2 in the comb-connected 3 by 3 arrays (Fig. S54).

Name	Sequence
Edg-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T2C7R00-1nt-Rec	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-T2C7R02-1nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-T2C7R04-1nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-T2C7R06-1nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-T2C7R08-1nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-T2C7R10-1nt-Rec	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-T2C7R12-1nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-T2C7R14-1nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-T2C7R16-1nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-T2C7R18-1nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-T2C7R20-1nt-Rec	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-T3C7R00-1nt-Rec	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-T3C7R02-1nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-T3C7R04-1nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-T3C7R06-1nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-T3C7R08-1nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-T3C7R10-1nt-Rec	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-T3C7R12-1nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-T3C7R14-1nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-T3C7R16-1nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-T3C7R18-1nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-T3C7R20-1nt-Rec	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-T4R00C7-DHP	GTGTCGTAGACACGAGCACGTATAACGTGCTATGGTTGCTTTGACGTGTCGTAGACAC
Edg-T4R02C7-DHP	GTGTCGTAGACACCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAGGTGTCGTAGACAC
Edg-T4R04C7-DHP	GTGTCGTAGACACATCACCCAAATCAAGTGCCCACTACGTGAACCGTGTCGTAGACAC
Edg-T4R06C7-DHP	GTGTCGTAGACACATCCTGTTTGATGGTGGCCCCAGCAGGCGAAAGTGTCGTAGACAC
Edg-T4R08C7-DHP	GTGTCGTAGACACGCTCACTGCCCGCTTTACATTAATTGCGTTGCGTGTCGTAGACAC
Edg-T4R10C7-DHP	GTGTCGTAGACACGTAACGCCAGGGTTTTAAGGCGATTAAGTTGGGTGTCGTAGACAC
Edg-T4R12C7-DHP	GTGTCGTAGACACCGTTGGTGTAGATGGGGTAATGGGATAGGTCAGTGTCGTAGACAC
Edg-T4R14C7-DHP	GTGTCGTAGACACTTTAAATTGTAAACGTATTGTATAAGCAAATAGTGTCGTAGACAC
Edg-T4R16C7-DHP	GTGTCGTAGACACGCCGGAGAGGGTAGCTTAGCTGATAAATTAATGTGTCGTAGACAC
Edg-T4R18C7-DHP	GTGTCGTAGACACAAATTTTTAGAACCCTTTCAACGCAAGGATAAGTGTCGTAGACAC
Edg-T4R20C7-DHP	GTGTCGTAGACACTAAGCAATAAAGCCTCAAAGAATTAGCAAAATGTGTCGTAGACAC

Table S28: Edge staples of Tile 3 in the comb-connected 3 by 3 arrays (Fig. S54).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3C7R00-1nt-G3	CGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G3	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G3	AAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G3	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G3	GTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G3	TCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G3	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G3	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G3	TTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G3	CTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G3	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

S11.13 Edge staples in comb-connected 4 by 4 arrays

Table S29: Edge staples of Tile 1 in the comb-connected 4 by 4 arrays (Fig. S55).

Name	Sequence
Edg-T1C7R04-2nt-G2	CGATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R08-5nt-G2	TCTTACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12-5nt-G2	GACTGCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R16-2nt-G2	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T2C7R04-2nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGC
Edg-T2C7R08-5nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCA
Edg-T2C7R12-5nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTA
Edg-T2C7R16-2nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAG
Edg-T3C7R04-2nt-G3	AAAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R08-5nt-G3	GGAAGTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-5nt-G3	TTACCGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R16-2nt-G3	TTTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T1C7R04-2nt-G4	ATATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T4C7R08-5nt-G1	ATCGCGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12-5nt-G1	AATTACGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T1C7R16-2nt-G4	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC

Table S30: Edge staples of Tile 2 in the comb-connected 4 by 4 arrays (Fig. S55).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12	CCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T3C7R04-2nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAAT
Edg-T3C7R08-5nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAA
Edg-T3C7R12-5nt-Rec	GTTATCTAAAATATCTAAAGGAATTGA
Edg-T3C7R16-2nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

Table S31: Edge staples of Tile 3 in the comb-connected 4 by 4 arrays (Fig. S55).

Name	Sequence
Edg-T1C7R04-2nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTT
Edg-T1C7R08-5nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGG
Edg-T1C7R12-5nt-Rec	CTGATAAATTGTGTCGAGATTTGTATC
Edg-T1C7R16-2nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTA
Edg-T2C7R04-2nt-G4	ATGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R08-5nt-G4	GGTCATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12-5nt-G4	GTTGCCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R16-2nt-G4	CCAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

Table S32: Edge staples of Tile 4 in the comb-connected 4 by 4 arrays (Fig. S55).

Name	Sequence
Edg-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R04-2nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAA
Edg-T4C7R08-5nt-Rec	GCTCACTGCCCGCTTTACATTAATTGC
Edg-T4C7R12-5nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATA
Edg-T4C7R16-2nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTA

S11.14 Edge staples in comb-connected 5 by 5 arrays

Table S33: Edge staples of Tile 1 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1C7R02-2nt-G2	ATTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-2nt-G2	CGATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-2nt-G2	GACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-2nt-G2	TACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12-2nt-G2	TGCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-2nt-G2	AGGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-2nt-G2	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-2nt-G2	TCGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T2C7R02-2nt-G2	ATGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-2nt-G2	CGGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-2nt-G2	GAGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-2nt-G2	TATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12-2nt-G2	TGCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-2nt-G2	AGTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-2nt-G2	CCAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-2nt-G2	TCTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T3C7R02-2nt-G2	ATAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-2nt-G2	CGAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-2nt-G2	GAAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-2nt-G2	TATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12-2nt-G2	TGGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-2nt-G2	AGACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-2nt-G2	CCTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-2nt-G2	TCTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T4C7R02-2nt-G2	ATCGGGCGCTAGGGCGCTAAGAAAGCGAAAGGAG
Edg-T4C7R04-2nt-G2	CGATCACCCAAATCAAGTGCCCACTACGTGAACC
Edg-T4C7R06-2nt-G2	GAATCCTGTTTGATGGTGGCCCCAGCAGGCGAAA
Edg-T4C7R08-2nt-G2	TAGCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12-2nt-G2	TGCGTTGGTGTAGATGGGGTAATGGGATAGGTCA
Edg-T4C7R14-2nt-G2	AGTTTAAATTGTAAACGTATTGTATAAGCAAATA
Edg-T4C7R16-2nt-G2	CCGCCGGAGAGGGTAGCTTAGCTGATAAATTAAT
Edg-T4C7R18-2nt-G2	TCAAATTTTTAGAACCCTTTCAACGCAAGGATAA

Table S34: Edge staples of Tile 2 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1C7R08	CGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12	CTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T2C7R02-2nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCG
Edg-T2C7R04-2nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGC
Edg-T2C7R06-2nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTG
Edg-T2C7R08-2nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGAC
Edg-T2C7R12-2nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCT
Edg-T2C7R14-2nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAAC
Edg-T2C7R16-2nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAG
Edg-T2C7R18-2nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGT
Edg-T3C7R00-1nt-Rec	GTAAAGTAATTCTGTCAAAGTACCGACAAAA
Edg-T3C7R02-1nt-Rec	AGTAGGGCTTAATTGAAAAGCCAACGCTCAA
Edg-T3C7R04-1nt-Rec	AATGGTTTGAAATACCCTTCTGACCTAAATT
Edg-T3C7R06-1nt-Rec	AGTCAATAGTGAATTTTTAAGACGCTGAGAA
Edg-T3C7R08-1nt-Rec	TGAGCAAAAGAAGATGATTCATTTCAATTAC
Edg-T3C7R10-1nt-Rec	CAATATAATCCTGATTGATGATGGCAATTCA
Edg-T3C7R12-1nt-Rec	GTTATCTAAAATATCTAAAGGAATTGAGGAA
Edg-T3C7R14-1nt-Rec	ACATCGCCATTAAAAAAACTGATAGCCCTAA
Edg-T3C7R16-1nt-Rec	TCGTCTGAAATGGATTACATTTTGACGCTCA
Edg-T3C7R18-1nt-Rec	TTGATTAGTAATAACATTGTAGCAATACTTC
Edg-T3C7R20-1nt-Rec	AGGAACGGTACGCCAGTAAAGGGATTTTAGA
Edg-T4C7R02-2nt-Rec	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGG
Edg-T4C7R04-2nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAA
Edg-T4C7R06-2nt-Rec	ATCCTGTTTGATGGTGGCCCCAGCAGGCGA
Edg-T4C7R08-2nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTT
Edg-T4C7R12-2nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGT
Edg-T4C7R14-2nt-Rec	TTTAAATTGTAAACGTATTGTATAAGCAAA
Edg-T4C7R16-2nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTA
Edg-T4C7R18-2nt-Rec	AAATTTTTAGAACCCTTTCAACGCAAGGAT

Table S35: Edge staples of Tile 3 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1C7R00-1nt-G1	TGGTGGCATCAATTCTAGGGCGCGAGCTGAAAA
Edg-T1C7R02-1nt-G1	TTCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-1nt-G1	CATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-1nt-G1	GCCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-1nt-G1	CCGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R10-1nt-G1	AGAAACACCAGAACGAGAGGCTTGCCCTGACGA
Edg-T1C7R12-1nt-G1	ACTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-1nt-G1	AGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-1nt-G1	AGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-1nt-G1	TGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T1C7R20-1nt-G1	AACAAACTACAACGCCTGAGTTTCGTCACCAGT
Edg-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12	CCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T3C7R00-1nt-G3	CGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G3	TAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G3	AAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G3	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G3	GTGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G3	TCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G3	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G3	GACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G3	TTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G3	CTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G3	GAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

Table S36: Edge staples of Tile 4 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1C7R00-1nt-Rec	GGTGGCATCAATTCTAGGGCGCGAGCTGAAA
Edg-T1C7R02-1nt-Rec	TCCCAATTCTGCGAACCCATATAACAGTTGA
Edg-T1C7R04-1nt-Rec	ATTGCTCCTTTTGATATTAGAGAGTACCTTT
Edg-T1C7R06-1nt-Rec	CCATAAATCAAAAATCCAGAAAACGAGAATG
Edg-T1C7R08-1nt-Rec	CGAGGCATAGTAAGAGACGCCAAAAGGAATT
Edg-T1C7R10-1nt-Rec	GAAACACCAGAACGAGAGGCTTGCCCTGACG
Edg-T1C7R12-1nt-Rec	CTGATAAATTGTGTCGAGATTTGTATCATCG
Edg-T1C7R14-1nt-Rec	GAACGAGGGTAGCAACGCGAAAGACAGCATC
Edg-T1C7R16-1nt-Rec	GGTTTATCAGCTTGCTAGCCTTTAATTGTAT
Edg-T1C7R18-1nt-Rec	GGGATTTTGCTAAACAAATGAATTTTCTGTA
Edg-T1C7R20-1nt-Rec	ACAAACTACAACGCCTGAGTTTCGTCACCAG
Edg-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R12	CCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

Table S37: Edge staples of Tile 5 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1C7R02-2nt-G4	AATCCCAATTCTGCGAACCCATATAACAGTTGAT
Edg-T1C7R04-2nt-G4	ATATTGCTCCTTTTGATATTAGAGAGTACCTTTA
Edg-T1C7R06-2nt-G4	TACCATAAATCAAAAATCCAGAAAACGAGAATGA
Edg-T1C7R08-2nt-G4	CACGAGGCATAGTAAGAGACGCCAAAAGGAATTA
Edg-T1C7R12-2nt-G4	GCCTGATAAATTGTGTCGAGATTTGTATCATCGC
Edg-T1C7R14-2nt-G4	AAGAACGAGGGTAGCAACGCGAAAGACAGCATCG
Edg-T1C7R16-2nt-G4	CCGGTTTATCAGCTTGCTAGCCTTTAATTGTATC
Edg-T1C7R18-2nt-G4	AGGGGATTTTGCTAAACAAATGAATTTTCTGTAT
Edg-T2C7R00-1nt-G2	TAGCCACCACCCTCATTGAACCGCCACCCTCAG
Edg-T2C7R02-1nt-G2	TGAGAGGGTTGATATAAGCGGATAAGTGCCGTC
Edg-T2C7R04-1nt-G2	GGTATAAACAGTTAATGTTGAGTAACAGTGCCC
Edg-T2C7R06-1nt-G2	AGCAGGTCAGACGATTGTTGACAGGAGGTTGAG
Edg-T2C7R08-1nt-G2	ATAGCGCGTTTTCATCGCTTTAGCGTCAGACTG
Edg-T2C7R10-1nt-G2	AGCGCCAAAGACAAAAGTTCATATGGTTTACCA
Edg-T2C7R12-1nt-G2	GCCGAAGCCCTTTTTAAAGCAATAGCTATCTTA
Edg-T2C7R14-1nt-G2	GTTTTTTGTTTAACGTCTCCAAATAAGAAACGA
Edg-T2C7R16-1nt-G2	CAACCTCCCGACTTGCGGCGAGGCGTTTTAGCG
Edg-T2C7R18-1nt-G2	CTAAACCAAGTACCGCATTCCAAGAACGGGTAT
Edg-T2C7R20-1nt-G2	GAGATAAGTCCTGAACACCTGTTTATCAACAAT
Edg-T3R00C7-DHP	GTGTCGTAGACACGTAAAGTAATTCTGTCAAAGTACCGACAAAAGGTGTCGTAGACAC
Edg-T3R02C7-DHP	GTGTCGTAGACACAGTAGGGCTTAATTGAAAAGCCAACGCTCAACGTGTCGTAGACAC
Edg-T3R04C7-DHP	GTGTCGTAGACACAATGGTTTGAAATACCCTTCTGACCTAAATTTGTGTCGTAGACAC
Edg-T3R06C7-DHP	GTGTCGTAGACACAGTCAATAGTGAATTTTTAAGACGCTGAGAAGGTGTCGTAGACAC
Edg-T3R08C7-DHP	GTGTCGTAGACACTGAGCAAAAGAAGATGATTCATTTCAATTACCGTGTCGTAGACAC
Edg-T3R10C7-DHP	GTGTCGTAGACACCAATATAATCCTGATTGATGATGGCAATTCATGTGTCGTAGACAC
Edg-T3R12C7-DHP	GTGTCGTAGACACGTTATCTAAAATATCTAAAGGAATTGAGGAAGGTGTCGTAGACAC
Edg-T3R14C7-DHP	GTGTCGTAGACACACATCGCCATTAAAAAAACTGATAGCCCTAAAGTGTCGTAGACAC
Edg-T3R16C7-DHP	GTGTCGTAGACACTCGTCTGAAATGGATTACATTTTGACGCTCAAGTGTCGTAGACAC
Edg-T3R18C7-DHP	GTGTCGTAGACACTTGATTAGTAATAACATTGTAGCAATACTTCTGTGTCGTAGACAC
Edg-T3R20C7-DHP	GTGTCGTAGACACAGGAACGGTACGCCAGTAAAGGGATTTTAGACGTGTCGTAGACAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

Table S38: Edge staples of Tile 6 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2C7R00-1nt-Rec	AGCCACCACCCTCATTGAACCGCCACCCTCA
Edg-T2C7R02-1nt-Rec	GAGAGGGTTGATATAAGCGGATAAGTGCCGT
Edg-T2C7R04-1nt-Rec	GTATAAACAGTTAATGTTGAGTAACAGTGCC
Edg-T2C7R06-1nt-Rec	GCAGGTCAGACGATTGTTGACAGGAGGTTGA
Edg-T2C7R08-1nt-Rec	TAGCGCGTTTTCATCGCTTTAGCGTCAGACT
Edg-T2C7R10-1nt-Rec	GCGCCAAAGACAAAAGTTCATATGGTTTACC
Edg-T2C7R12-1nt-Rec	CCGAAGCCCTTTTTAAAGCAATAGCTATCTT
Edg-T2C7R14-1nt-Rec	TTTTTTGTTTAACGTCTCCAAATAAGAAACG
Edg-T2C7R16-1nt-Rec	AACCTCCCGACTTGCGGCGAGGCGTTTTAGC
Edg-T2C7R18-1nt-Rec	TAAACCAAGTACCGCATTCCAAGAACGGGTA
Edg-T2C7R20-1nt-Rec	AGATAAGTCCTGAACACCTGTTTATCAACAA
Edg-T3C7R08	TGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R12	GTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T4C7R00-1nt-Rec	GAGCACGTATAACGTGCTATGGTTGCTTTGA
Edg-T4C7R02-1nt-Rec	CGGGCGCTAGGGCGCTAAGAAAGCGAAAGGA
Edg-T4C7R04-1nt-Rec	ATCACCCAAATCAAGTGCCCACTACGTGAAC
Edg-T4C7R06-1nt-Rec	ATCCTGTTTGATGGTGGCCCCAGCAGGCGAA
Edg-T4C7R08-1nt-Rec	GCTCACTGCCCGCTTTACATTAATTGCGTTG
Edg-T4C7R10-1nt-Rec	GTAACGCCAGGGTTTTAAGGCGATTAAGTTG
Edg-T4C7R12-1nt-Rec	CGTTGGTGTAGATGGGGTAATGGGATAGGTC
Edg-T4C7R14-1nt-Rec	TTTAAATTGTAAACGTATTGTATAAGCAAAT
Edg-T4C7R16-1nt-Rec	GCCGGAGAGGGTAGCTTAGCTGATAAATTAA
Edg-T4C7R18-1nt-Rec	AAATTTTTAGAACCCTTTCAACGCAAGGATA
Edg-T4C7R20-1nt-Rec	TAAGCAATAAAGCCTCAAAGAATTAGCAAAA

Table S39: Edge staples of Tile 7 in the comb-connected 5 by 5 arrays (Fig. S56).

Name	Sequence
Edg-T1R00C7-DHP	GTGTCGTAGACACGGTGGCATCAATTCTAGGGCGCGAGCTGAAAAGTGTCGTAGACAC
Edg-T1R02C7-DHP	GTGTCGTAGACACTCCCAATTCTGCGAACCCATATAACAGTTGATGTGTCGTAGACAC
Edg-T1R04C7-DHP	GTGTCGTAGACACATTGCTCCTTTTGATATTAGAGAGTACCTTTAGTGTCGTAGACAC
Edg-T1R06C7-DHP	GTGTCGTAGACACCCATAAATCAAAAATCCAGAAAACGAGAATGAGTGTCGTAGACAC
Edg-T1R08C7-DHP	GTGTCGTAGACACCGAGGCATAGTAAGAGACGCCAAAAGGAATTAGTGTCGTAGACAC
Edg-T1R10C7-DHP	GTGTCGTAGACACGAAACACCAGAACGAGAGGCTTGCCCTGACGAGTGTCGTAGACAC
Edg-T1R12C7-DHP	GTGTCGTAGACACCTGATAAATTGTGTCGAGATTTGTATCATCGCGTGTCGTAGACAC
Edg-T1R14C7-DHP	GTGTCGTAGACACGAACGAGGGTAGCAACGCGAAAGACAGCATCGGTGTCGTAGACAC
Edg-T1R16C7-DHP	GTGTCGTAGACACGGTTTATCAGCTTGCTAGCCTTTAATTGTATCGTGTCGTAGACAC
Edg-T1R18C7-DHP	GTGTCGTAGACACGGGATTTTGCTAAACAAATGAATTTTCTGTATGTGTCGTAGACAC
Edg-T1R20C7-DHP	GTGTCGTAGACACACAAACTACAACGCCTGAGTTTCGTCACCAGTGTGTCGTAGACAC
Edg-T2R00C7-DHP	GTGTCGTAGACACAGCCACCACCCTCATTGAACCGCCACCCTCAGGTGTCGTAGACAC
Edg-T2R02C7-DHP	GTGTCGTAGACACGAGAGGGTTGATATAAGCGGATAAGTGCCGTCGTGTCGTAGACAC
Edg-T2R04C7-DHP	GTGTCGTAGACACGTATAAACAGTTAATGTTGAGTAACAGTGCCCGTGTCGTAGACAC
Edg-T2R06C7-DHP	GTGTCGTAGACACGCAGGTCAGACGATTGTTGACAGGAGGTTGAGGTGTCGTAGACAC
Edg-T2R08C7-DHP	GTGTCGTAGACACTAGCGCGTTTTCATCGCTTTAGCGTCAGACTGGTGTCGTAGACAC
Edg-T2R10C7-DHP	GTGTCGTAGACACGCGCCAAAGACAAAAGTTCATATGGTTTACCAGTGTCGTAGACAC
Edg-T2R12C7-DHP	GTGTCGTAGACACCCGAAGCCCTTTTTAAAGCAATAGCTATCTTAGTGTCGTAGACAC
Edg-T2R14C7-DHP	GTGTCGTAGACACTTTTTTGTTTAACGTCTCCAAATAAGAAACGAGTGTCGTAGACAC
Edg-T2R16C7-DHP	GTGTCGTAGACACAACCTCCCGACTTGCGGCGAGGCGTTTTAGCGGTGTCGTAGACAC
Edg-T2R18C7-DHP	GTGTCGTAGACACTAAACCAAGTACCGCATTCCAAGAACGGGTATGTGTCGTAGACAC
Edg-T2R20C7-DHP	GTGTCGTAGACACAGATAAGTCCTGAACACCTGTTTATCAACAATGTGTCGTAGACAC
Edg-T3C7R00-1nt-G4	TGTAAAGTAATTCTGTCAAAGTACCGACAAAAG
Edg-T3C7R02-1nt-G4	AAGTAGGGCTTAATTGAAAAGCCAACGCTCAAC
Edg-T3C7R04-1nt-G4	TAATGGTTTGAAATACCCTTCTGACCTAAATTT
Edg-T3C7R06-1nt-G4	AAGTCAATAGTGAATTTTTAAGACGCTGAGAAG
Edg-T3C7R08-1nt-G4	ATGAGCAAAAGAAGATGATTCATTTCAATTACC
Edg-T3C7R10-1nt-G4	GCAATATAATCCTGATTGATGATGGCAATTCAT
Edg-T3C7R12-1nt-G4	CGTTATCTAAAATATCTAAAGGAATTGAGGAAG
Edg-T3C7R14-1nt-G4	AACATCGCCATTAAAAAAACTGATAGCCCTAAA
Edg-T3C7R16-1nt-G4	CTCGTCTGAAATGGATTACATTTTGACGCTCAA
Edg-T3C7R18-1nt-G4	GTTGATTAGTAATAACATTGTAGCAATACTTCT
Edg-T3C7R20-1nt-G4	CAGGAACGGTACGCCAGTAAAGGGATTTTAGAC
Edg-T4C7R08	GCTCACTGCCCGCTTTACATTAATTGCGTTGC
Edg-T4C7R12	CGTTGGTGTAGATGGGGTAATGGGATAGGTCA

S11.15 Staples with extensions for creating patterns

Table S40: Staples with double-stranded extensions in a pattern of two arcs.

Name	Sequence
Arc1-T1R07C4	AGATTTAGACGATAAAAACCAAAAATCGTCATTTTTTTTTTTTTTTTTTTTT
Arc1-T1R08C3	TTAAGAGGGTCCAATACTGCGGATAGCGAGTTTTTTTTTTTTTTTTTTTT
Arc1-T1R08C5	GTCAGAAGATTGAATCCCCCTCAACCTCGTTTTTTTTTTTTTTTTTTTTTTT
Arc1-T1R09C4	ACCCAAATAACTTTAATCATTGTGATCAGTTGTTTTTTTTTTTTTTTTTTTT
Arc1-T1R09C6	GTGAATATAGTAAATTGGGCTTTAATGCAGTTTTTTTTTTTTTTTTTTTT
Arc1-T1R10C3	AGGCTTTTCAGGTAGAAAGATTCAATTACCTTTTTTTTTTTTTTTTTTTT
Arc1-T1R10C5	ACCAGACGGAATACCACATTCAACGAGATGGTTTTTTTTTTTTTTTTTTTTT
Arc1-T1R11C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATTTTTTTTTTTTTTTTTTTTTT
Arc1-T1R11C6	ACAACGGAAATCCGCGACCTGCCTCATTCATTTTTTTTTTTTTTTTTTTT
Arc1-T1R12C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTTTTTTTTTTTTTTTTTTTTTT
Arc1-T1R13C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGTTTTTTTTTTTTTTTTTTTTT
Arc1-T2R07C6	AGTTTGCGCATTTTCGGTCATAGAGCCGCCTTTTTTTTTTTTTTTTTTTT
Arc1-T2R09C6	TAGAAAAGGCGACATTCAACCGCAGAATCATTTTTTTTTTTTTTTTTTTT
Arc1-T2R10C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGGTTTTTTTTTTTTTTTTTTTT
Arc1-T2R11C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGACTTTTTTTTTTTTTTTTTTTT
Arc1-T2R11C6	ATGAAATGAAAAGTAAGCAGATACAATCAATTTTTTTTTTTTTTTTTTTT
Arc1-T2R12C3	TTAAAGGTACATATAAAAGAAACAAACGCATTTTTTTTTTTTTTTTTTTT
Arc1-T2R12C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAACTTTTTTTTTTTTTTTTTTTT
Arc1-T2R13C4	TGCCAGTTATAACATAAAAACAGGACAAGAATTTTTTTTTTTTTTTTTTTTT
Arc1-T2R14C5	AAAGTTACGCCCAATAATAAGAGCAGCCTTTATTTTTTTTTTTTTTTTTTTT
Arc1-T3R07C4	CTTTGAATTACATTTAACAATTTCTAATTAATTTTTTTTTTTTTTTTTTTTT
Arc1-T3R08C3	TATATAACGTAAATCGTCGCTATATTTGAATTTTTTTTTTTTTTTTTTTT
Arc1-T3R08C5	CTACCTTTAGAATCCTTGAAAACAAGAAAACATTTTTTTTTTTTTTTTTTTT
Arc1-T3R09C4	CCAGAAGGTTAGAACCTACCATATCCTGATTGTTTTTTTTTTTTTTTTTTTT
Arc1-T3R09C6	ATTATCAGTTTGGATTATACTTGCGCAGAGTTTTTTTTTTTTTTTTTTTT
Arc1-T3R10C3	TTACCTTTACAATAACGGATTCGCAAAATTTTTTTTTTTTTTTTTTTTTT
Arc1-T3R10C5	AAATTAATACCAAGTTACAAAATCCTGAATAATTTTTTTTTTTTTTTTTTTT
Arc1-T3R11C4	CCTCAATCCGTCAATAGATAATACAGAAACCATTTTTTTTTTTTTTTTTTTT
Arc1-T3R11C6	ACAGTTGTTAGGAGCACTAACATATTCCTGTTTTTTTTTTTTTTTTTTTT
Arc1-T3R12C5	TGGAAGGGAGCGGAATTATCATCAACTAATAGTTTTTTTTTTTTTTTTTTTT
Arc1-T3R13C6	ATGCGCGTACCGAACGAACCACGCAAATCATTTTTTTTTTTTTTTTTTTT
Arc1-T4R07C6	CTAACTCCCAGTCGGGAAACCTGGTCCACGTTTTTTTTTTTTTTTTTTTT
Arc1-T4R09C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAGTTTTTTTTTTTTTTTTTTTT
Arc1-T4R10C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACGTTTTTTTTTTTTTTTTTTTT
Arc1-T4R11C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTCTTTTTTTTTTTTTTTTTTTT
Arc1-T4R11C6	ATTGACCCGCATCGTAACCGTGAGGGGGATTTTTTTTTTTTTTTTTTTTT
Arc1-T4R12C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCCTTTTTTTTTTTTTTTTTTTT
Arc1-T4R13C4	ACCCCGGTTGTTAAATCAGCTCATAGTAACAATTTTTTTTTTTTTTTTTTTT
Arc1-T4R14C5	AGTTTGAGATTCTCCGTGGGAACAATTCGCATTTTTTTTTTTTTTTTTTTTT
Arc2-T1R09C6	GTGAATATAGTAAATTGGGCTTTAATGCAGTTTTTTTTTTTTTTTTTTTT
Arc2-T1R10C5	ACCAGACGGAATACCACATTCAACGAGATGGTTTTTTTTTTTTTTTTTTTTT
Arc2-T1R11C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATTTTTTTTTTTTTTTTTTTTTT
Arc2-T1R11C6	ACAACGGAAATCCGCGACCTGCCTCATTCATTTTTTTTTTTTTTTTTTTT
Arc2-T1R12C3	TTATGCGATTGACAAGAACCGGAGGTCAATTTTTTTTTTTTTTTTTTTTT
Arc2-T1R12C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTTTTTTTTTTTTTTTTTTTTTT
Arc2-T1R13C4	GAGTTAAATTCATGAGGAAGTTTCTCTTTGACTTTTTTTTTTTTTTTTTTTT
Arc2-T1R13C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGTTTTTTTTTTTTTTTTTTTTT
Arc2-T1R14C5	ACTTAGCCATTATACCAAGCGCGAGAGGACTATTTTTTTTTTTTTTTTTTTT
Arc2-T2R07C4	TAGCAGCATTGCCATCTTTTCATACACCCTCATTTTTTTTTTTTTTTTTTTT
Arc2-T2R08C3	GTCTCTGACACCCTCAGAGCCACATCAAAATTTTTTTTTTTTTTTTTTTT

Name	Sequence
Arc2-T2R08C5	AATCCTCAACCAGAACCACCACCAGCCCCCTTTTTTTTTTTTTTTTTTTTTT
Arc2-T2R09C4	ACCACGGATAAATATTGACGGAAAACCATCGATTTTTTTTTTTTTTTTTTTT
Arc2-T2R09C6	TAGAAAAGGCGACATTCAACCGCAGAATCATTTTTTTTTTTTTTTTTTTT
Arc2-T2R10C3	TCACCGGAAACGTCACCAATGAATTATTCATTTTTTTTTTTTTTTTTTTT
Arc2-T2R10C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGGTTTTTTTTTTTTTTTTTTTT
Arc2-T2R11C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGACTTTTTTTTTTTTTTTTTTTT
Arc2-T2R11C6	ATGAAATGAAAAGTAAGCAGATACAATCAATTTTTTTTTTTTTTTTTTTT
Arc2-T2R12C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAACTTTTTTTTTTTTTTTTTTTTT
Arc2-T2R13C6	ATCCCAAAAAAATGAAAATAGCAAGAAACATTTTTTTTTTTTTTTTTTTT
Arc2-T3R09C6	ATTATCAGTTTGGATTATACTTGCGCAGAGTTTTTTTTTTTTTTTTTTTT
Arc2-T3R10C5	AAATTAATACCAAGTTACAAAATCCTGAATAATTTTTTTTTTTTTTTTTTTT
Arc2-T3R11C4	CCTCAATCCGTCAATAGATAATACAGAAACCATTTTTTTTTTTTTTTTTTTT
Arc2-T3R11C6	ACAGTTGTTAGGAGCACTAACATATTCCTGTTTTTTTTTTTTTTTTTTTT
Arc2-T3R12C3	ATTTGCACCATTTTGCGGAACAAATTTGAGTTTTTTTTTTTTTTTTTTTT
Arc2-T3R12C5	TGGAAGGGAGCGGAATTATCATCAACTAATAGTTTTTTTTTTTTTTTTTTTT
Arc2-T3R13C4	AGACAATAAGAGGTGAGGCGGTCATATCAAACTTTTTTTTTTTTTTTTTTTT
Arc2-T3R13C6	ATGCGCGTACCGAACGAACCACGCAAATCATTTTTTTTTTTTTTTTTTTT
Arc2-T3R14C5	ATTAGAGCAATATCTGGTCAGTTGCAGCAGAATTTTTTTTTTTTTTTTTTTT
Arc2-T4R07C4	AAGTGTAATAATGAATCGGCCAACCACCGCCTTTTTTTTTTTTTTTTTTTTT
Arc2-T4R08C3	TGAGTGTTCAGCTGATTGCCCTTGCGCGGGTTTTTTTTTTTTTTTTTTTT
Arc2-T4R08C5	TATAAATCGAGAGTTGCAGCAAGCGTCGTGCCTTTTTTTTTTTTTTTTTTTT
Arc2-T4R09C4	TTCGCTATTGCCAAGCTTGCATGCGAAGCATATTTTTTTTTTTTTTTTTTTT
Arc2-T4R09C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAGTTTTTTTTTTTTTTTTTTTT
Arc2-T4R10C3	GAGAGGCGACAACATACGAGCCGCTGCAGGTTTTTTTTTTTTTTTTTTTT
Arc2-T4R10C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACGTTTTTTTTTTTTTTTTTTTT
Arc2-T4R11C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTCTTTTTTTTTTTTTTTTTTTT
Arc2-T4R11C6	ATTGACCCGCATCGTAACCGTGAGGGGGATTTTTTTTTTTTTTTTTTTTT
Arc2-T4R12C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCCTTTTTTTTTTTTTTTTTTTT
Arc2-T4R13C6	CAGGAAGTAATATTTTGTTAAAAACGGCGGTTTTTTTTTTTTTTTTTTTT
A20	AAAAAAAAAAAAAAAAAAAA

Table S41: Staples with double-stranded extensions in a pattern of a T shape.

Name	Sequence
T-T1R06C3	TTAAGAGGGTCCAATACTGCGGATAGCGAGTTTTTTTTTTTTTTTTTTTT
T-T1R06C5	GTCAGAAGATTGAATCCCCCTCAACCTCGTTTTTTTTTTTTTTTTTTTTTT
T-T1R08C3	AGGCTTTTCAGGTAGAAAGATTCAATTACCTTTTTTTTTTTTTTTTTTTT
T-T1R08C5	ACCAGACGGAATACCACATTCAACGAGATGGTTTTTTTTTTTTTTTTTTTT
T-T1R09C1	CGAACTAAATTATACCAGTCAGGACATAGGCTGGCTGACCTTTGAAAGTTTTTTTTTTTTTTTTTTTT
T-T1R10C3	TTATGCGATTGACAAGAACCGGAGGTCAATTTTTTTTTTTTTTTTTTTTT
T-T1R10C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTTTTTTTTTTTTTTTTTTTTT
T-T1R11C4	ACCCAAATAACTTTAATCATTGTGATCAGTTGTTTTTTTTTTTTTTTTTTTT
T-T1R11C6	GTGAATATAGTAAATTGGGCTTAATGCAGTTTTTTTTTTTTTTTTTTTTT
T-T1R13C2	AAAAGAATAACCGAACTGACCAACTTCATCAATTTTTTTTTTTTTTTTTTTT
T-T1R13C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATTTTTTTTTTTTTTTTTTTTTT
T-T1R13C6	ACAACGGAAATCCGCGACCTGCCTCATTCATTTTTTTTTTTTTTTTTTTT
T-T1R15C4	GAGTTAAATTCATGAGGAAGTTTCTCTTTGACTTTTTTTTTTTTTTTTTTTT
T-T1R15C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGTTTTTTTTTTTTTTTTTTTT
T-T2R06C3	GTCTCTGACACCCTCAGAGCCACATCAAAATTTTTTTTTTTTTTTTTTTT
T-T2R06C5	AATCCTCAACCAGAACCACCACCAGCCCCCTTTTTTTTTTTTTTTTTTTTT
T-T2R08C3	TCACCGGAAACGTCACCAATGAATTATTCATTTTTTTTTTTTTTTTTTTT
T-T2R08C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGGTTTTTTTTTTTTTTTTTTTT
T-T2R09C1	ACCATTACCGACTTGAGCCATTTGCAAACGTAGAAAATACCTGGCATGTTTTTTTTTTTTTTTTTTTT
T-T2R10C3	TTAAAGGTACATATAAAAGAAACAAACGCATTTTTTTTTTTTTTTTTTTT
T-T2R10C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAACTTTTTTTTTTTTTTTTTTTT
T-T2R11C4	ACCACGGATAAATATTGACGGAAAACCATCGATTTTTTTTTTTTTTTTTTTT
T-T2R11C6	TAGAAAAGGCGACATTCAACCGCAGAATCATTTTTTTTTTTTTTTTTTTT
T-T2R13C2	CGCTAATAGGAATACCCAAAAGAAATACATAATTTTTTTTTTTTTTTTTTTT
T-T2R13C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGACTTTTTTTTTTTTTTTTTTTT
T-T2R13C6	ATGAAATGAAAAGTAAGCAGATACAATCAATTTTTTTTTTTTTTTTTTTT
T-T2R15C4	TGCCAGTTATAACATAAAAACAGGACAAGAATTTTTTTTTTTTTTTTTTTTT
T-T2R15C6	ATCCCAAAAAAAATGAAAATAGCAAGAAACATTTTTTTTTTTTTTTTTTTT
T-T3R06C3	TATATAACGTAAATCGTCGCTATATTTGAATTTTTTTTTTTTTTTTTTTT
T-T3R06C5	CTACCTTTAGAATCCTTGAAAACAAGAAAACATTTTTTTTTTTTTTTTTTTT
T-T3R08C3	TTACCTTTACAATAACGGATTCGCAAAATTTTTTTTTTTTTTTTTTTTTT
T-T3R08C5	AAATTAATACCAAGTTACAAAATCCTGAATAATTTTTTTTTTTTTTTTTTTT
T-T3R09C1	ACAGTACCGAAATTGCGTAGATTTGTTATTAATTTTAAAAAACAATTCTTTTTTTTTTTTTTTTTTTT
T-T3R10C3	ATTTGCACCATTTTGCGGAACAAATTTGAGTTTTTTTTTTTTTTTTTTTT
T-T3R10C5	TGGAAGGGAGCGGAATTATCATCAACTAATAGTTTTTTTTTTTTTTTTTTTT
T-T3R11C4	CCAGAAGGTTAGAACCTACCATATCCTGATTGTTTTTTTTTTTTTTTTTTTT
T-T3R11C6	ATTATCAGTTTGGATTATACTTGCGCAGAGTTTTTTTTTTTTTTTTTTTT
T-T3R13C2	GCATCACCAGTATTAGACTTTACAGTTTGAGTTTTTTTTTTTTTTTTTTTTT
T-T3R13C4	CCTCAATCCGTCAATAGATAATACAGAAACCATTTTTTTTTTTTTTTTTTTT
T-T3R13C6	ACAGTTGTTAGGAGCACTAACATATTCCTGTTTTTTTTTTTTTTTTTTTT
T-T3R15C4	AGACAATAAGAGGTGAGGCGGTCATATCAAACTTTTTTTTTTTTTTTTTTTT
T-T3R15C6	ATGCGCGTACCGAACGAACCACGCAAATCATTTTTTTTTTTTTTTTTTTT
T-T4R06C3	TGAGTGTTCAGCTGATTGCCCTTGCGCGGGTTTTTTTTTTTTTTTTTTTT
T-T4R06C5	TATAAATCGAGAGTTGCAGCAAGCGTCGTGCCTTTTTTTTTTTTTTTTTTTT
T-T4R08C3	GAGAGGCGACAACATACGAGCCGCTGCAGGTTTTTTTTTTTTTTTTTTTT
T-T4R08C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACGTTTTTTTTTTTTTTTTTTTT
T-T4R09C1	ATTGTTATCCGAGCTCGAATTCGTGCCATTCGCCATTCAGTTCCGGCATTTTTTTTTTTTTTTTTTTT
T-T4R10C3	TCGACTCTGAAGGGCGATCGGTGCGGCCTCTTTTTTTTTTTTTTTTTTTT
T-T4R10C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCCTTTTTTTTTTTTTTTTTTTT
T-T4R11C4	TTCGCTATTGCCAAGCTTGCATGCGAAGCATATTTTTTTTTTTTTTTTTTTT
T-T4R11C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAGTTTTTTTTTTTTTTTTTTTT
T-T4R13C2	TTCATCAACGCACTCCAGCCAGCTGCTGCGCATTTTTTTTTTTTTTTTTTTT

Name	Sequence
T-T4R13C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTCTTTTTTTTTTTTTTTTTTTT
T-T4R13C6	ATTGACCCGCATCGTAACCGTGAGGGGGATTTTTTTTTTTTTTTTTTTT
T-T4R15C4	ACCCCGGTTGTTAAATCAGCTCATAGTAACAATTTTTTTTTTTTTTTTTTTT
T-T4R15C6	CAGGAAGTAATATTTTGTTAAAAACGGCGGTTTTTTTTTTTTTTTTTTTT

Table S42: Staples with dumbbell extensions in a pattern of two arcs (Fig. S25).

Name	Sequence
Arc-T1C2R06	CCCGATTTAATCGTAAACGCTCCTCTTTTGAGGAACAAGTTTTCTTGTCATCA
Arc-T1C3R06	TTAAGAGGGTCCAATATCCTCTTTTGAGGAACAAGTTTTCTTGTCTGCGGATAGCGAG
Arc-T1C3R08	AGGCTTTTCAGGTAGATCCTCTTTTGAGGAACAAGTTTTCTTGTAAGATTCAATTACC
Arc-T1C4R09	AGATTTAGACGATAAATCCTCTTTTGAGGAACAAGTTTTCTTGTAACCAAAAATCGTCAT
Arc-T1C4R11	ACCCAAATAACTTTAATCCTCTTTTGAGGAACAAGTTTTCTTGTTCATTGTGATCAGTTG
Arc-T1C5R08	ACCAGACGGAATACCATCCTCTTTTGAGGAACAAGTTTTCTTGTCATTCAACGAGATGGT
Arc-T1C5R10	TTAATTTCCAACGTAATCCTCTTTTGAGGAACAAGTTTTCTTGTCAAAGCTGTCCATGTT
Arc-T1C6R11	GTGAATATAGTAAATCCTCTTTTGAGGAACAAGTTTTCTTGTTTGGGCTTTAATGCAG
Arc-T1C6R13	ACAACGGAAATCCGTCCTCTTTTGAGGAACAAGTTTTCTTGTCGACCTGCCTCATTCA
Arc-T1C7R10	GAAACACCAGAACGAGAGGCTTGCTCCTCTTTTGAGGAACAAGTTTTCTTGTCCTGACGA
Arc-T1C7R12	CTGATAAATTGTGTCGAGATTTGTTCCTCTTTTGAGGAACAAGTTTTCTTGTATCATCGC
Arc-T2C3R12	ATAATAACTCAGAGAGTCCTCTTTTGAGGAACAAGTTTTCTTGTATAACCCGAAGCGC
Arc-T2C3R14	ATTAGACGGAGCGTCTTCCTCTTTTGAGGAACAAGTTTTCTTGTTTCCAGAGCTACAA
Arc-T2C4R13	TGAGTTAACAGAAGGATCCTCTTTTGAGGAACAAGTTTTCTTGTAACCGAGGGCAAAGAC
Arc-T2C4R15	TGCCAGTTATAACATATCCTCTTTTGAGGAACAAGTTTTCTTGTAAAACAGGACAAGAAT
Arc-T2C5R10	AGGGAAGGATAAGTTTTCCTCTTTTGAGGAACAAGTTTTCTTGTATTTTGTCAGCCGAAC
Arc-T2C5R12	AAAGTTACGCCCAATATCCTCTTTTGAGGAACAAGTTTTCTTGTATAAGAGCAGCCTTTA
Arc-T2C6R11	TAGAAAAGGCGACATCCTCTTTTGAGGAACAAGTTTTCTTGTTTCAACCGCAGAATCA
Arc-T2C6R13	ATGAAATGAAAAGTTCCTCTTTTGAGGAACAAGTTTTCTTGTAAGCAGATACAATCAA
Arc-T2C7R08	TAGCGCGTTTTCATCGCTTTAGCGTCCTCTTTTGAGGAACAAGTTTTCTTGTTCAGACTG
Arc-T2C7R10	GCGCCAAAGACAAAAGTTCATATGTCCTCTTTTGAGGAACAAGTTTTCTTGTGTTTACCA
Arc-T3C2R06	ATGTATTACGCTAACGGAGATCCTCTTTTGAGGAACAAGTTTTCTTGTATTAA
Arc-T3C3R06	TATATAACGTAAATCGTCCTCTTTTGAGGAACAAGTTTTCTTGTTCGCTATATTTGAA
Arc-T3C3R08	TTACCTTTACAATAACTCCTCTTTTGAGGAACAAGTTTTCTTGTGGATTCGCAAAATT
Arc-T3C4R09	CTTTGAATTACATTTATCCTCTTTTGAGGAACAAGTTTTCTTGTACAATTTCTAATTAAT
Arc-T3C4R11	CCAGAAGGTTAGAACCTCCTCTTTTGAGGAACAAGTTTTCTTGTTACCATATCCTGATTG
Arc-T3C5R08	AAATTAATACCAAGTTTCCTCTTTTGAGGAACAAGTTTTCTTGTACAAAATCCTGAATAA
Arc-T3C5R10	TGGAAGGGAGCGGAATTCCTCTTTTGAGGAACAAGTTTTCTTGTTATCATCAACTAATAG
Arc-T3C6R11	ATTATCAGTTTGGATCCTCTTTTGAGGAACAAGTTTTCTTGTTTATACTTGCGCAGAG
Arc-T3C6R13	ACAGTTGTTAGGAGTCCTCTTTTGAGGAACAAGTTTTCTTGTCACTAACATATTCCTG
Arc-T3C7R10	CAATATAATCCTGATTGATGATGGTCCTCTTTTGAGGAACAAGTTTTCTTGTCAATTCAT
Arc-T3C7R12	GTTATCTAAAATATCTAAAGGAATTCCTCTTTTGAGGAACAAGTTTTCTTGTTGAGGAAG
Arc-T4C3R12	AGGAAGATCATTAAATTCCTCTTTTGAGGAACAAGTTTTCTTGTGTGAGCGTTTTTAA
Arc-T4C3R14	CCAATAGGAAACTAGCTCCTCTTTTGAGGAACAAGTTTTCTTGTATGTCAAGGAGCAA
Arc-T4C4R13	CCCGTCGGGGGACGACTCCTCTTTTGAGGAACAAGTTTTCTTGTGACAGTATCGGGCCTC
Arc-T4C4R15	ACCCCGGTTGTTAAATTCCTCTTTTGAGGAACAAGTTTTCTTGTCAGCTCATAGTAACAA
Arc-T4C5R10	ACGGCCAGTACGCCAGTCCTCTTTTGAGGAACAAGTTTTCTTGTCTGGCGAACATCTGCC
Arc-T4C5R12	AGTTTGAGATTCTCCGTCCTCTTTTGAGGAACAAGTTTTCTTGTTGGGAACAATTCGCAT
Arc-T4C6R11	GTGCTGCCCCAGTCTCCTCTTTTGAGGAACAAGTTTTCTTGTACGACGTTTGAGTGAG
Arc-T4C6R13	ATTGACCCGCATCGTCCTCTTTTGAGGAACAAGTTTTCTTGTTAACCGTGAGGGGGAT
Arc-T4C7R08	GCTCACTGCCCGCTTTACATTAATTCCTCTTTTGAGGAACAAGTTTTCTTGTTGCGTTGC
Arc-T4C7R10	GTAACGCCAGGGTTTTAAGGCGATTCCTCTTTTGAGGAACAAGTTTTCTTGTTAAGTTGG

Table S43: Staples with hairpin extensions in a pattern of two arcs (Fig. S25).

Name	Sequence
HP-ARC-T1R07C4	AGATTTAGACGATAAAAACCAAAAATCGTCATTTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R08C3	TTAAGAGGGTCCAATACTGCGGATAGCGAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R08C5	GTCAGAAGATTGAATCCCCCTCAACCTCGTTTTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R09C4	ACCCAAATAACTTTAATCATTGTGATCAGTTGTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R09C6	GTGAATATAGTAAATTGGGCTTTAATGCAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R10C3	AGGCTTTTCAGGTAGAAAGATTCAATTACCTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R10C5	ACCAGACGGAATACCACATTCAACGAGATGGTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R11C4	CCCCAGCGGGAACGAGGCGCAGACTATTCATTTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R11C6	ACAACGGAAATCCGCGACCTGCCTCATTCATTTTTTTTTTTAAAAAAAA
HP-ARC-T1R12C5	TTAATTTCCAACGTAACAAAGCTGTCCATGTTTTTTTTTTTTAAAAAAAA
HP-ARC-T1R13C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R07C6	AGTTTGCGCATTTTCGGTCATAGAGCCGCCTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R09C6	TAGAAAAGGCGACATTCAACCGCAGAATCATTTTTTTTTTTAAAAAAAA
HP-ARC-T2R10C5	ATTAGCGTCCGTAATCAGTAGCGAATTGAGGGTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R11C4	TGAGTTAACAGAAGGAAACCGAGGGCAAAGACTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R11C6	ATGAAATGAAAAGTAAGCAGATACAATCAATTTTTTTTTTTAAAAAAAA
HP-ARC-T2R12C3	TTAAAGGTACATATAAAAGAAACAAACGCATTTTTTTTTTTAAAAAAAA
HP-ARC-T2R12C5	AGGGAAGGATAAGTTTATTTTGTCAGCCGAACTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R13C4	TGCCAGTTATAACATAAAAACAGGACAAGAATTTTTTTTTTTTAAAAAAAA
HP-ARC-T2R14C5	AAAGTTACGCCCAATAATAAGAGCAGCCTTTATTTTTTTTTTTAAAAAAAA
HP-ARC-T3R07C4	CTTTGAATTACATTTAACAATTTCTAATTAATTTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R08C3	TATATAACGTAAATCGTCGCTATATTTGAATTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R08C5	CTACCTTTAGAATCCTTGAAAACAAGAAAACATTTTTTTTTTTAAAAAAAA
HP-ARC-T3R09C4	CCAGAAGGTTAGAACCTACCATATCCTGATTGTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R09C6	ATTATCAGTTTGGATTATACTTGCGCAGAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R10C3	TTACCTTTACAATAACGGATTCGCAAAATTTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R10C5	AAATTAATACCAAGTTACAAAATCCTGAATAATTTTTTTTTTTAAAAAAAA
HP-ARC-T3R11C4	CCTCAATCCGTCAATAGATAATACAGAAACCATTTTTTTTTTTAAAAAAAA
HP-ARC-T3R11C6	ACAGTTGTTAGGAGCACTAACATATTCCTGTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R12C5	TGGAAGGGAGCGGAATTATCATCAACTAATAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T3R13C6	ATGCGCGTACCGAACGAACCACGCAAATCATTTTTTTTTTTAAAAAAAA
HP-ARC-T4R07C6	CTAACTCCCAGTCGGGAAACCTGGTCCACGTTTTTTTTTTTAAAAAAAA
HP-ARC-T4R09C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAGTTTTTTTTTTTAAAAAAAA
HP-ARC-T4R10C5	AGCTGCATAGCCTGGGGTGCCTAAGTAAAACGTTTTTTTTTTTAAAAAAAA
HP-ARC-T4R11C4	CCCGTCGGGGGACGACGACAGTATCGGGCCTCTTTTTTTTTTTAAAAAAAA
HP-ARC-T4R11C6	ATTGACCCGCATCGTAACCGTGAGGGGGATTTTTTTTTTTAAAAAAAA
HP-ARC-T4R12C5	ACGGCCAGTACGCCAGCTGGCGAACATCTGCCTTTTTTTTTTTAAAAAAAA
HP-ARC-T4R13C4	ACCCCGGTTGTTAAATCAGCTCATAGTAACAATTTTTTTTTTTAAAAAAAA
HP-ARC-T4R14C5	AGTTTGAGATTCTCCGTGGGAACAATTCGCATTTTTTTTTTTAAAAAAAA

Table S44: Staples with bridge-style extensions in a pattern of two arcs (Fig. S25).

Name	Sequence
Ext-T1R09C7	CGAGGCATAGTAAGAGACGCCAAAAGGAATTAGGAGTTAGTTTTTTTTAAGTTAGGGA
Ext-T1R11C6	ACAACGGAAATCCGCGACCTGCCTCATTCATTGAGGTAAGGTTTGATTGGAG
Ext-T1R13C6	CTCAGCAGGCTACAGAGGCTTTAACAAAGTTTTGGAGAGTTGAGGTGTGGGT
Ext-T1R14C5	ACTTAGCCATTATACCAAGCGCGAGAGGACTATTAGGAGTTAGTAAGTTAGGGA
Ext-T1R15C4	TTTCACGTCGATAGTTGCGCCGACCTTGCAGGTTGAGGTAAGGTTTGATTGGAG
Ext-T1R16C3	CGGGTAAAATTCGGTCGCTGAGGAATGACATTTGGAGAGTTGTTTTTTTAGGTGTGGGT
Ext-T2R05C4	GAGCCGCCTTAAAGCCAGAATGGAGATGATACTTAGGAGTTAGTAAGTTAGGGA
Ext-T2R06C5	TTATTCTGACTGGTAATAAGTTTTAACAAATATTGAGGTAAGGTTTGATTGGAG
Ext-T2R08C5	AATCCTCAACCAGAACCACCACCAGCCCCCTTTTTGGAGAGTTGAGGTGTGGGT
Ext-T2R09C6	TAGAAAAGGCGACATTCAACCGCAGAATCATTAGGAGTTAGTTTTTTTTAAGTTAGGGA
Ext-T2R11C7	GCGCCAAAGACAAAAGTTCATATGGTTTATTGAGGTAAGGTTTGATTGGAG
Ext-T3R09C7	TGAGCAAAAGAAGATGATTCATTTCAATTTTAGGAGTTAGTTTTTTTTAAGTTAGGGA
Ext-T3R11C6	ACAGTTGTTAGGAGCACTAACATATTCCTGTTGAGGTAAGGTTTGATTGGAG
Ext-T3R13C6	ATGCGCGTACCGAACGAACCACGCAAATCATTTGGAGAGTTGAGGTGTGGGT
Ext-T3R14C5	ATTAGAGCAATATCTGGTCAGTTGCAGCAGAATTAGGAGTTAGTAAGTTAGGGA
Ext-T3R15C4	CCAGCCATCCAGTAATAAAAGGGACGTGGCACTTGAGGTAAGGTTTGATTGGAG
Ext-T3R16C3	CACCGCCTGAAAGCGTAAGAATACATTCTGTTTGGAGAGTTGTTTTTTTAGGTGTGGGT
Ext-T4R05C4	GGCCCTGAAAAAGAATAGCCCGAGCGTGGACTTTAGGAGTTAGTAAGTTAGGGA
Ext-T4R06C5	AGCACTAAAAAGGGCGAAAAACCGAAATCCCTTTGAGGTAAGGTTTGATTGGAG
Ext-T4R08C5	TATAAATCGAGAGTTGCAGCAAGCGTCGTGCCTTTGGAGAGTTGAGGTGTGGGT
Ext-T4R09C6	GTGCTGCCCCAGTCACGACGTTTGAGTGAGTTAGGAGTTAGTTTTTTTTAAGTTAGGGA
Ext-T4R11C7	GTAACGCCAGGGTTTTAAGGCGATTAAGTTTGAGGTAAGGTTTGATTGGAG
Bri-T2R05	AGGAGTGTAAACATGAAAGTATTAAGAGGCTTTTTTTGCGAATAATAATTT
Bri-T4R05	CCAACGTCATCGGAACCCTAAAGGGAGCCCTTTTTTTGAACAATATTACCG
B1	ACCTTACCTCTCCCTAACTT
B2	CAACTCTCCACTCCAATCAA
B3	ACTAACTCCTACCCACACCT