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Supporting Information

Computer-Aided Production of Scaffolded DNA Nanostructures from Flat Sheet Meshes

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Supplementary methods

Structure design

All meshes presented here were designed in the Stanford triangle format (PLY), this is the input format for our routing pipeline. Export to this format is available in many computer graphics software like Blender. Autodesk Maya however does not currently support export to PLY but several free software are available for the conversion to PLY, we used meshconv, a simple command line converter or meshlab, a mesh processing application with a graphical user interface and useful features for mesh clean-up and repair.

The PLY format is user readable and meshes can easily be created by hand or by script. The 6-tesselation mesh and the ring mesh were created using python scripts. These scripts first generate the vertex coordinates for the mesh and then generate the description of the faces of the mesh. In the PLY format, only the vertex coordinates and how they are connected in faces is explicitly described.

The 4-tesselation mesh was designed in blender as a simple polygon mesh, Autodesk Maya does not appear to support the export of non-triangulated meshes. The 3-tesselation mesh was designed in Maya as a polygon mesh that was triangulated and stretched to make all edges equally long. The three-hole disc mesh was designed in Maya by first creating a larger triangulated polygon mesh. Then the faces not wanted in the final design were deleted as outlined in figure 1. Maya will however automatically fill internal holes like the eyes of the three-hole disc with triangulated faces. After conversion of the mesh to PLY, these faces were manually removed from the PLY file. The map of Scandinavia was created in a similar way by deleting faces from a larger mesh canvas and moving and scaling edges to create a better outline. For the hand shaped mesh, the palm was first created as a polygon mesh and the fingers were then added as extrusions to the mesh.

The PLY format files were then placed in the same folder as the new version of our routing and relaxation package 'Beam SCaffolded Origami Routing' (BSCOR) available from www.vhelix.net. The software is run from command line in windows by navigating to the folder and typing:

BSCOR *filename.ply scaling_value*

Here, *filename.ply* is the name of the mesh file and *scaling_value* is a user input decimal value that determines the size of the final DNA design. This software first finds a scaffold path through the mesh and then starts the physical relaxation simulation to find the DNA configuration of the mesh with the lowest strain. After finishing, the script outputs a file with the same name as the mesh but in the .rpoly format containing a description of the DNA structure.

The .rpoly files were imported to our DNA design plugin for Maya: vHelix, available from www.vhelix.net. In the import, vHelix automatically designs the staple strands by putting staple breakpoints on every edge. We then applied a scaffold sequence and from this, vHelix automatically calculates the sequence of the complimentary staple oligonucleotides. To further reduce strain in the structure we used the feature "auto fill strand gaps" in vHelix. This feature will introduce unpaired nucleotides in large gaps on

the scaffold and staples. After exporting the staple strand sequences, these unpaired nucleotides can be assigned to any type, we used Adenines.

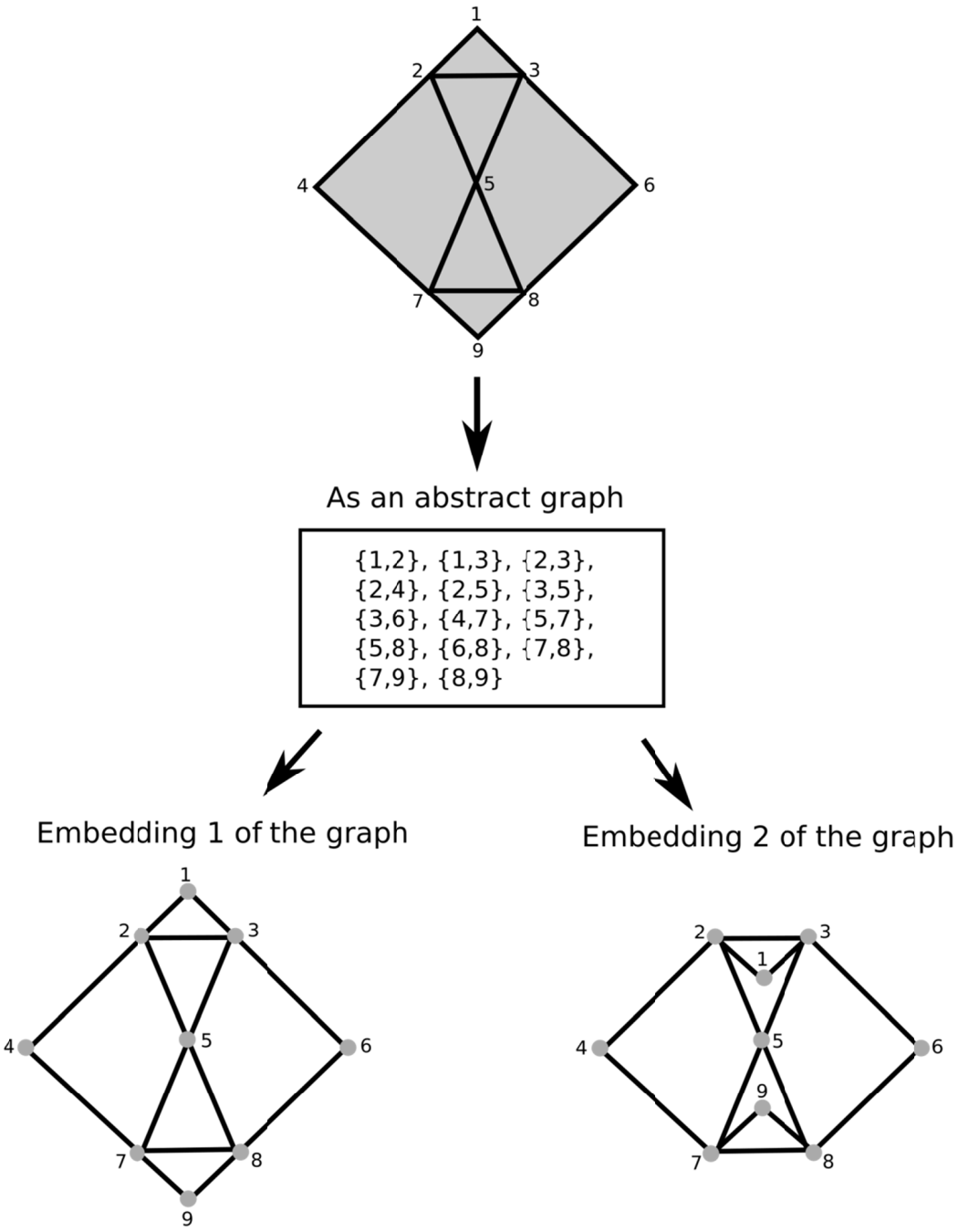
Algorithm for routing 2D meshes

For conciseness, we leave the definition of theoretical concepts from this section and refer the reader to Supplementary Note 1 from Benson et al[1]. The support for 'topologically' flat object inputs was achieved by a modification of the 'bscor' software package introduced in the aforementioned work. The modification only alters the modules preceding the A-trail finding component in the scaffold routing script.

To recap, the scaffold routing in the original pipeline consists of four steps (c.f. Supplementary Note 1 and Extended Data Figure 3 in Benson et al.[1]). First, the 3D mesh, given as an ASCII PLY file, is converted to an abstract graph representation in a DIMACS format. Second, the graph is reconditioned for routing by the addition of edges (to change the parity of odd-degree vertices). Third, the Boyer-Myrvold[2] algorithm is applied to generate a planar embedding (local cyclic order of edges around vertices) of the abstract graph. Finally, an A-trail search algorithm is employed to output the actual routing as a sequence of edges or vertices.

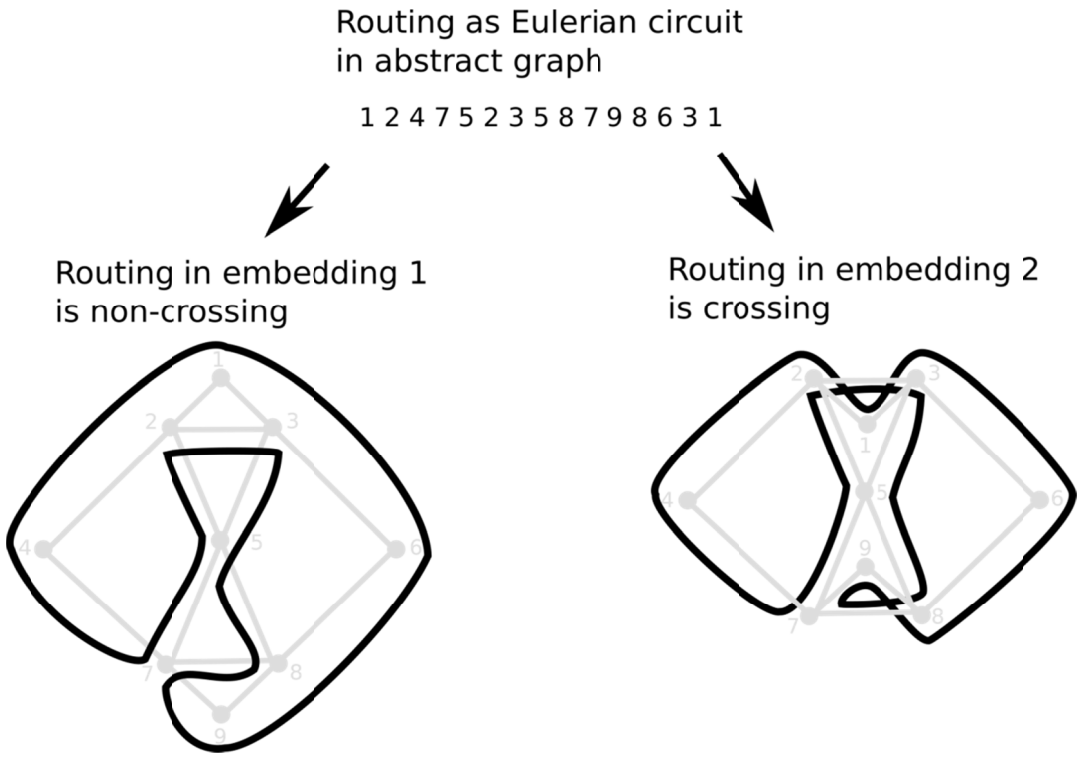
A key result which allows the application of a standard planar embedding algorithm for fetching the local rotation of edges is Whitney's unique embedding theorem[3] . The theorem implies that 3-connected planar graphs (equivalently polyhedral graphs) have a unique local order of edges (up-to choice of the first edge and the clockwise/counterclockwise orientation of edge rotation). However, non-polyhedral graphs can have two or more non-isomorphic embeddings. For instance, the graph in Supplementary Figure 1 has two non-equivalent embeddings. Indeed, the local rotation around vertex 2 in embedding 1, i.e. ({1,2}, {3, 2}, {5,2}, {4,2}), is neither cyclically- nor mirror-equivalent to the rotation in embedding 2, i.e. ({1,2}, {5,2}, {4,2}, {3,2}). Since the graph is Eulerian, the rotation can equivalently be stated in terms of adjacent vertices. Then, it becomes evident that (1, 3, 5, 4) can neither be shifted nor reversed to (1 5 4 3). As illustrated in Supplementary Figure 2, an Eulerian circuit, specified as sequence of vertices (or edges) can be an A-trail in one embedding while not being one in another. Thus, fetching the correct embedding is paramount to meet the design criteria.

Hence, the modified pipeline implements a new approach for fetching the appropriate embedding both when the input is a 3D mesh inflatable to a ball and when it is a surface deformable to a flat sheet. To achieve this, the new algorithm exploits the face list information directly from the PLY file instead of the edge list information in the abstract graph. The scheme for the new method is illustrated in Supplementary Figure 3. In this figure, the faces of the object are all described as a counter-clockwise list of their bounding vertices. The last line corresponds to the unbounded outer face, and is not available in PLY files generated from 3D modeling software. It is listed here for simplifying the first explanation of the algorithm.



Supplementary figure 1. Two non-isomorphic embeddings of an abstract planar graph obtained from a 2D mesh. The local orders of adjacent vertices in the two embeddings are different for some of the vertices. For instance, the clockwise order for vertex 2 is (1 3 5 4) in embedding 1, but (1 5 4 3) in

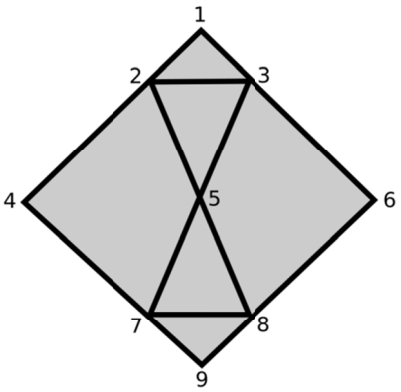
embedding 2. Here, vertices 1 and 5 are consecutive in the second order but vertex 3 interjects them in the first.



Supplementary figure 2. An Eulerian circuit which is or is not an A-trail depending on the embedding. The circuit is an A-trail, and thus non-crossing, in the first embedding. It is however not an A-trail in the second embedding as it crosses itself at vertices 2, 3 and 8. This illustrates the importance of finding the correct embedding corresponding to the mesh.

The algorithm proceeds as follows for each vertex *v*. First, it scans the complete face list to find all the faces which vertex *v* bounds. For instance, while scanning vertex 2 in Supplementary Figure 3, the algorithm would fetch faces (1 2 3), (2 5 3), (2 4 7 5) and (2 1 3 6 8 9 7 4). To generate the local rotation of vertices (edges) around *v*, the algorithm first adds the vertex *w* succeeding *v* in the first face. In our running example, vertex 3 would first be appended to an initially empty list corresponding to the order around vertex 2. In the succeeding stages, the algorithm appends the vertex succeeding vertex v in the other face to which the edge {w, v} belongs. In the second stage of the current example, edge {3, 2} appears in the second face (2 5 3), and thus vertex 5 will be appended next. Next, {5, 2} appears in face (2 4 7 5); hence, vertex 4 will be added to the list. Then, {4, 2} is found in the unbounded face (2 1 3 6 8 9 7 4) and thus vertex 1 will be added. The algorithm stops when it finds the first vertex it added. In the current example, the procedure find the previously added vertex 3 again and thus would stop. The resulting order of adjacent vertices for vertex 2 follows the order of addition and in this instance is 3, 5,

4, 1. This is the correct clockwise order around vertex 2 (c.f. line 2 in the embedding generated in Supplementary Figure 3.)



Object's faces described as counter-clockwise list of bounding vertices (availiable in PLY file)

```
1 2 3
2 5 3
2 4 7 5
3 5 8 6
5 7 8
7 9 8
2 1 3 6 8 9 7 4
```

Local clockwise cyclic rotation of vertices (equiv. edges) obtained from face list

```
1 : 2 3
2 : 3 5 4 1
3 : 1 6 5 2
4 : 7 2
5 : 3 8 7 2
6 : 3 8
7 : 5 8 9 4
8 : 6 9 7 5
9 : 8 7
```

Supplementary figure 3. A schematic for obtaining an embedding from the PLY face list. If all faces are listed in the PLY, and are all described in the same orientation, the embedding can be found algorithmically.

The above procedure yields the clockwise ordering of edges/vertices for a list of faces all described in counter-clockwise fashion. When all faces are listed, and they are described consistently (in terms of orientation), and the graph does not contain a bridge (an edge whose removal creates multiple components); each edge appears in two faces and in opposing directions. For instance, the edge connecting vertex 2 and 3, appears as (2, 3) in the face (1 2 3) and as (3, 2) in the face (2 5 3). When these conditions are met, the algorithm runs until it stops by finding the originally added vertex. Moreover, it goes through the adjacent faces of a vertex in a consistent orientation (e.g. in clockwise order when the faces are described counter-clockwise). It then follows that it fetches the local rotation of vertex/edges in a consistent orientation (clockwise in the current setting).

But, what about when some faces are not described, as is the case for the unbounded face when obtaining a PLY file from 3D software? The situation is exacerbated when the object contains holes, as in the three-hole disc in Figure 1B, since such holes are not listed in the PLY file generated from Maya. The user can add the unbounded face and the holes in the PLY file, and the new embedding algorithm would function; but, we can aid the user even in this setting. In the above formulation, the algorithm only exploited one direction for fetching the order. More concretely, it only appended to the local order list by going through the adjacent faces of v in clockwise order. The algorithm would get stuck if it could not find the next face, i.e. when the face is not listed in the PLY file. For instance, it would not find edge {4, 2} in the unbounded face when building the order for vertex 2, if the unbounded face would not be listed. However, the algorithm can also prepend edges/vertices to the list by going through the adjacent faces in the counter-clockwise direction. In the example, the algorithm can go back to the original face, i.e. (1 2 3) and attempt to find the next face in counter-clockwise direction. Since, it does not find any; it can stop, outputting the same order as when the unbounded face was described.

The two-directional navigation of adjacent faces works as long as there is only one face adjacent to a vertex which is not described. However, when there are two faces adjacent to a vertex which are not described, the algorithm gets stuck in between the two holes. For instance, suppose, in addition to the unbounded face, face (2 5 3) was not listed in the PLY file. Then, face (1 2 3) would have two holes as neighbors: holes (2 5 3) and (2 1 3 6 8 9 7 4). As the algorithm traverses the faces in the clockwise direction, it would immediately get stuck when moving from (1 2 3) to (2 5 3) as the latter cannot be found in the PLY. On the other hand when it scans in the counter-clockwise direction, it would also get stuck because (2 1 3 6 8 9 7 4) is also unlisted.

For a mesh with n vertices, f faces and maximum vertex degree Δ, the new embedding algorithm has a worst-case runtime of $\mathcal{O}(nf + n\Delta^2)$. The maximum number of faces (achieved in plane triangulations) is linear in n (1.5n more exactly), and the average degree in planar graphs is at most six (since planar triangulations have $3n-6$ edges). Thus, nf is at most quadratic in n and $n\Delta^2$ is in practical settings linear in n (all vertices to be implemented as branched DNA junctions would not have more than a certain constant number of arms.) Nevertheless, the runtime can most likely be improved; but the worst-case exponential time A-trail search algorithm clearly dominates the embedding algorithm in the bscor pipeline, and improvements to the embedding algorithm are secondary from the scaffold routing viewpoint.

Folding (including washing)

For the structures, we used two widely used[4] M13 variants as scaffold strand. The p7560 scaffold was used for the 6-tesselation, the Hand and the map of Scandinavia. The p8064 scaffold was used for the 4-tesselation, the 3-tesselation, the Ring and the Three-hole disc.

Staple strands were ordered desalted from IDT Europe in DNAse free water at a concentration of 100 µM. Staple strand sequences are available in supplementary table 2-8. The scaffold strand was prepared from modified m13 phage as described before[1]. In the folding reactions the scaffold strand concentration was 5 nM and the staple strand concentration 50 nM each. For the standard folding experiments the buffer was 10 mM $MgCl_2$, 5 mM TRIS and 1 mM EDTA (all VWR international). For folding in PBS, 10 x PBS (Sigma Aldrich) was diluted to 1x in the folding reactions. After mixing, samples were put in a thermo cycler on a thermal ramp starting with a denaturing step of 80 °C for 5 minutes followed by a cooling to 60 °C over 20 minutes, then a slower cooling to 24 °C over 14 hours.

After folding, the excess staple strands were removed as to not interfere with imaging. The samples were diluted to 500 µl in their folding buffer and placed in a 100 kDa MWCO spin filter (Millipore). The filter was centrifuged at 14 000 x g for 2 minutes. After this, the flow trough was discarded and the sample in the filter again diluted to 500 µl. The sample was again centrifuged at 14 000 x g for 2 minutes. After centrifugation, the sample in the filter was diluted to its initial concentration and the filter put upside down in a fresh centrifugation tube. This was centrifuged for 2 minutes at 1 000 x g to recover the sample.

AFM

Imaging was performed in a fluid cell formed by gluing a disc of mica to the center of a microscopy slide using epoxy glue. Around the mica disk, a plastic ring was glued using repro rubber.

For AFM imaging of structures folded in standard folding buffer, the samples were first diluted 10 times in folding buffer and 10 µl was added to freshly cleaved mica. After 30 seconds, 4 µl of 5 mM $NiSO_4$ (Merck Millipore) was added to the sample on the mica. This was incubated for 4.5 minutes and then the surface was washed with 1 ml of folding buffer. For imaging, 1.5 ml of folding buffer was added to the mica disc.

Structures folded in PBS were diluted 2-5 times in 1 x PBS. The cleaved mica was first incubated with 10 µl of 5 mM $NiSO_4$ for 5 minutes. Using a pipette, most of the nickel solution was removed before 10 µl of the diluted sample was added to the mica surface, this was incubated for 5 minutes. Then, 1.5 ml of imaging buffer (10 mM NaCl (VWR international) and 1-3 mM $NiSO_4$) was added to the sample and imaging started.

Imaging was performed using a JPK instruments nanowizard 3 ultra with a Bruker Scanasyst fluid + cantilever in AC mode.

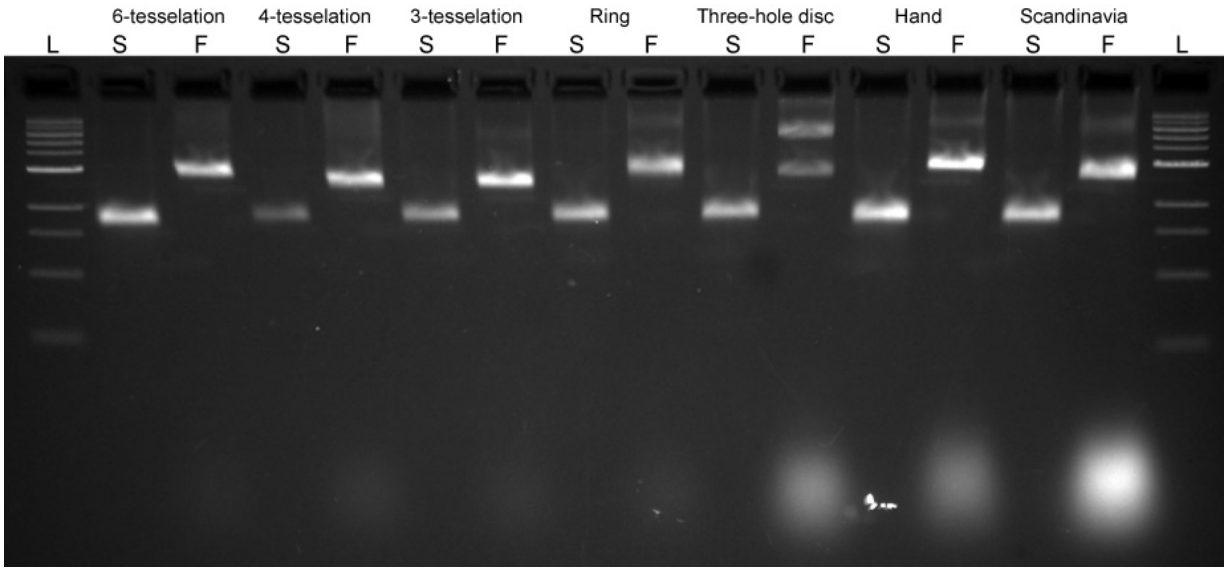
References

[1] E. Benson, A. Mohammed, J. Gardell, S. Masich, E. Czeizler, P. Orponen, B. Högberg, *Nature* **2015**, *523*, 441–444.

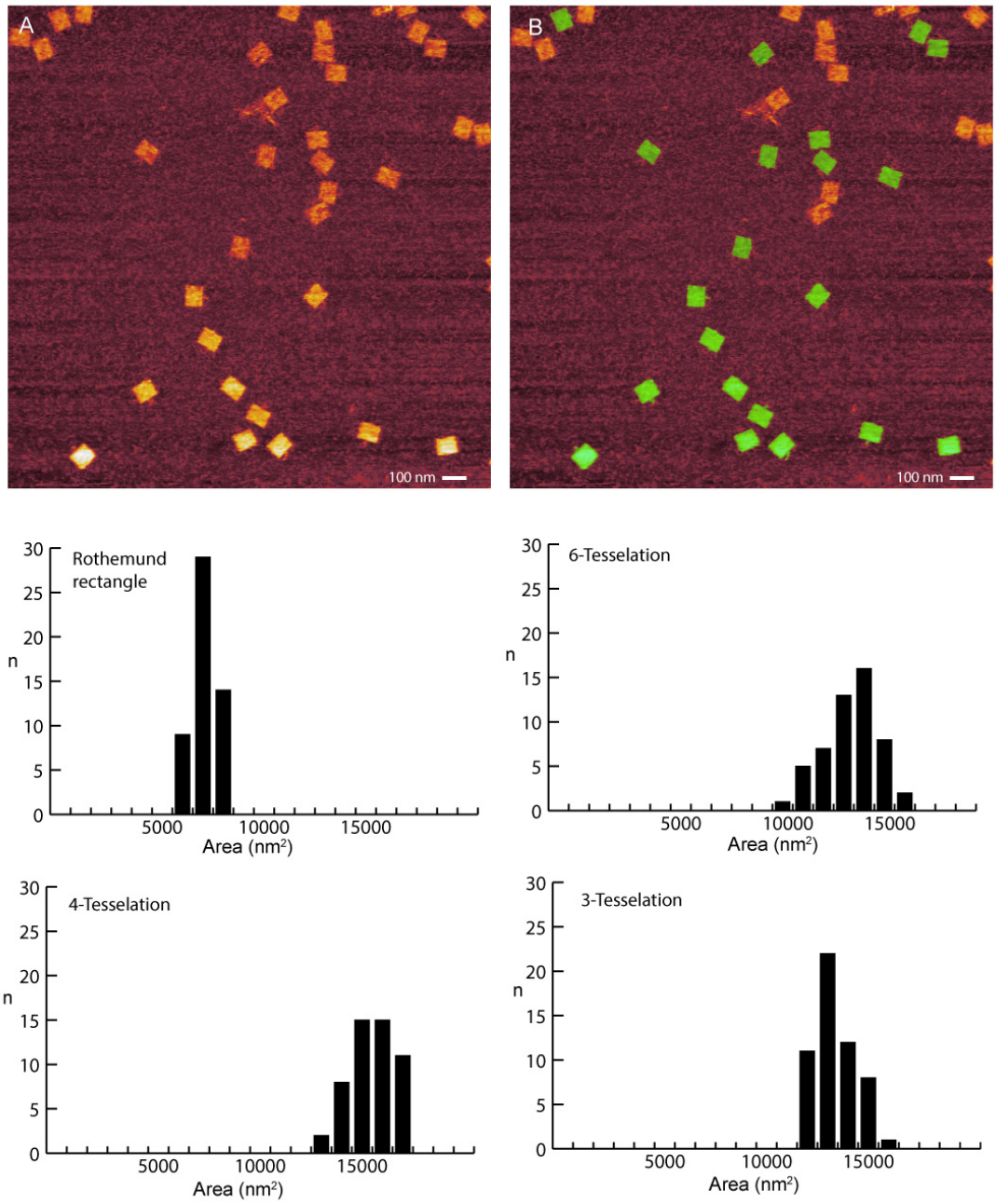
[2] J. M. Boyer, W. J. Myrvold, *J. Graph Algorithms Appl.* **2004**, *8*, 241–273.

[3] H. Whitney, *Am. J. Math.* **1932**, *54*, 150–168.

[4] S. M. Douglas, H. Dietz, T. Liedl, B. Högberg, F. Graf, W. M. Shih, *Nature* **2009**, *459*, 414–8.



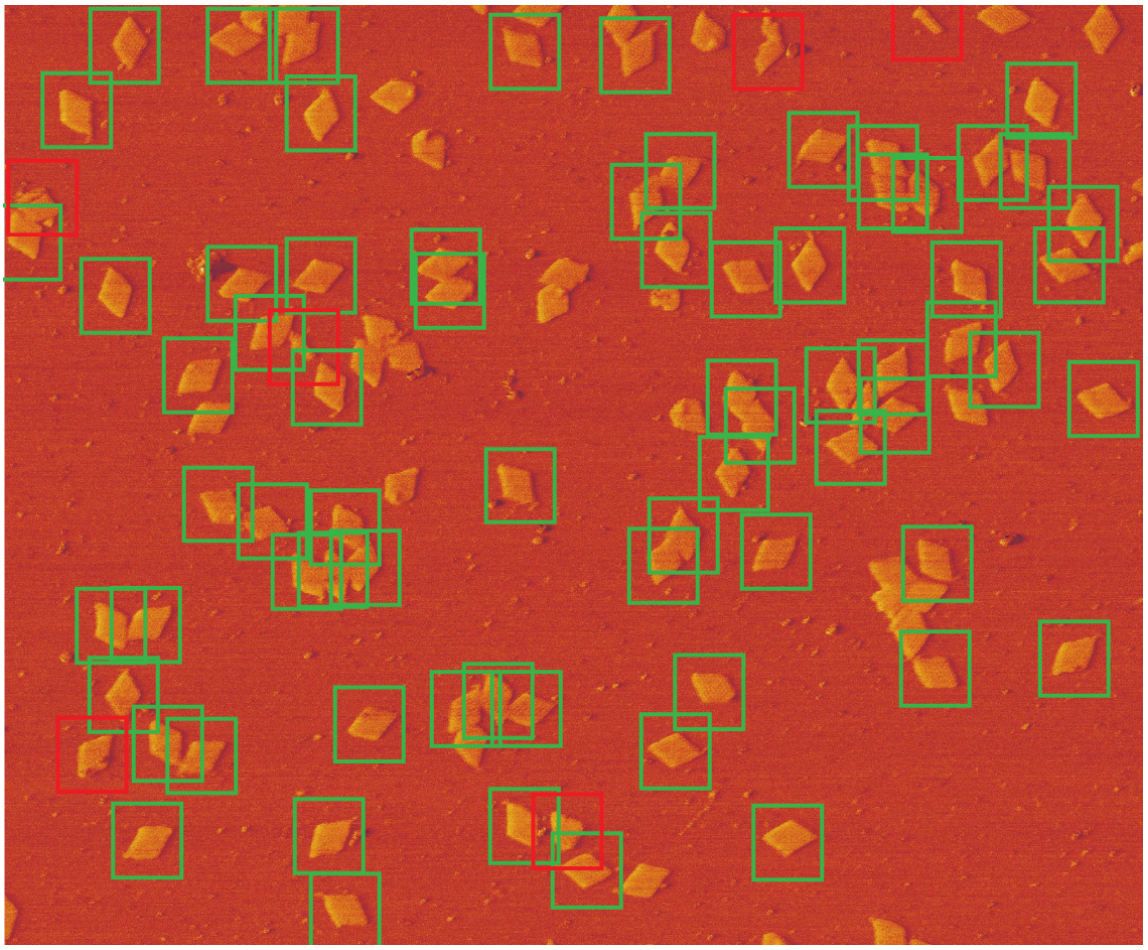
Supplementary figure 4. Agarose gel electrophoresis of folded structures. Structures were folded (F) and run in comparison to their scaffold (S). As ladder 1kb ladder from New England Biolabs was used. A 2% agarose gel with 0.5 X TBE and 10 mM $MgCl_2$ pre stained with EthBr was run for 4h at 70 V on ice and image in a GE healthcare LAS 4010 gel imager.



Supplementary figure 5. Area measurement from AFM. AFM data was analyzed using the software Gwyddion A) show a height image of the twist corrected Rothemund rectangle that was used as a reference object. The feature “mark grains by segmentation” was used to apply masks to nanostructures as is seen in B). Structures that were touching the edge of the image were automatically removed. Size filtration was used to remove small grains and large masks covering multiple touching/overlapping structures. Some masks that were not corresponding to nanostructures had to be manually removed. The projected area of the masks, corresponding to the surface area of the structures was exported and is shown in the histograms. Addition data is shown in Supplementary table 1.

Supplementary table 1. Area measurements of flat sheets.

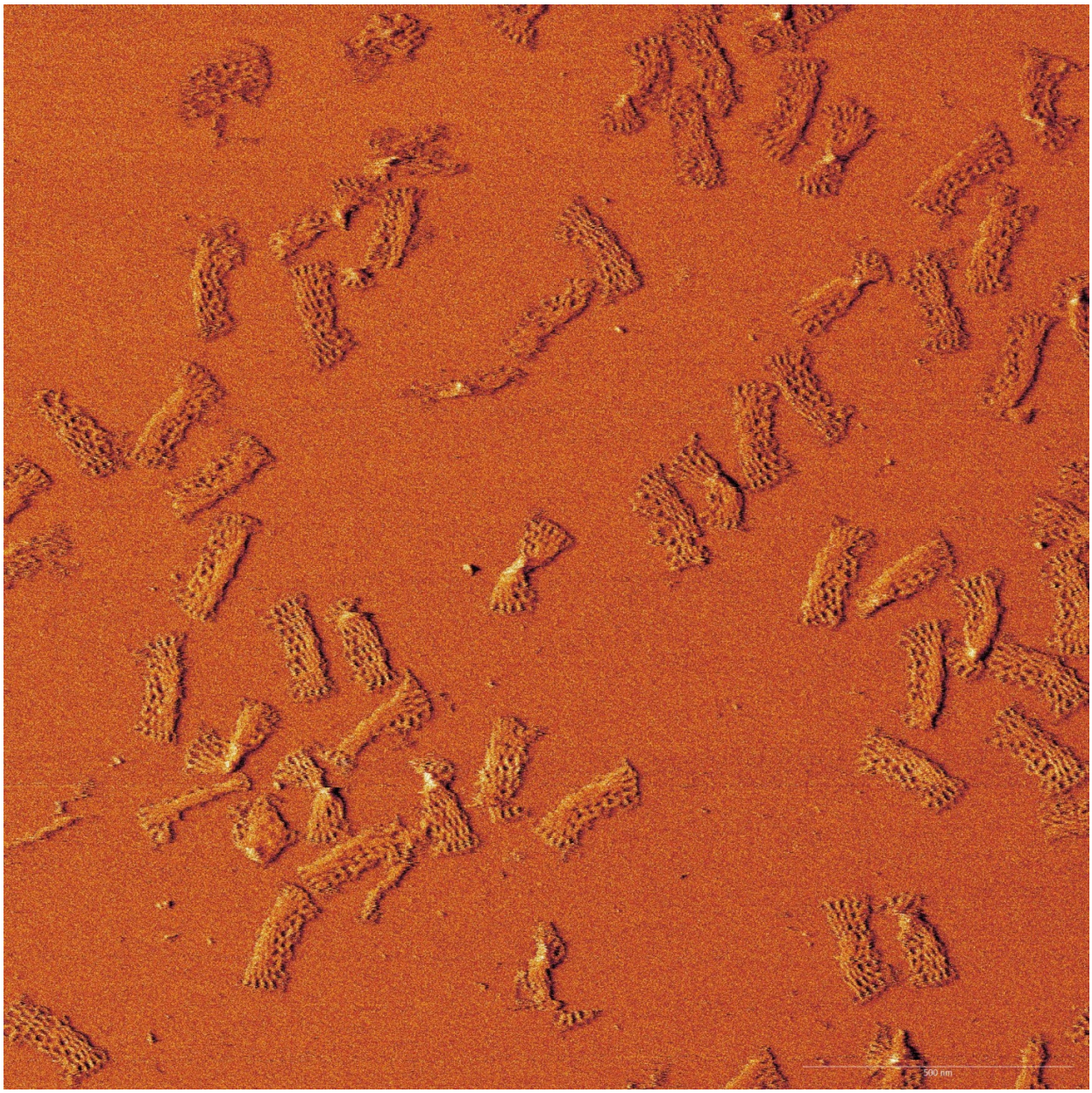
	Nr measured	Average area (nm^2)	max	min	Base use	Relative area
Twist corrected Rothemund rectangle	52	6 613	7 748	5 684	6768	1
6-tesselation	52	13 775	16 610	10 400	7461	1,889537
4-tesselation	51	15 081	16 960	12 710	7922	1,948306
3-tesselation	54	12 831	15 400	11 101	7706	1,704088



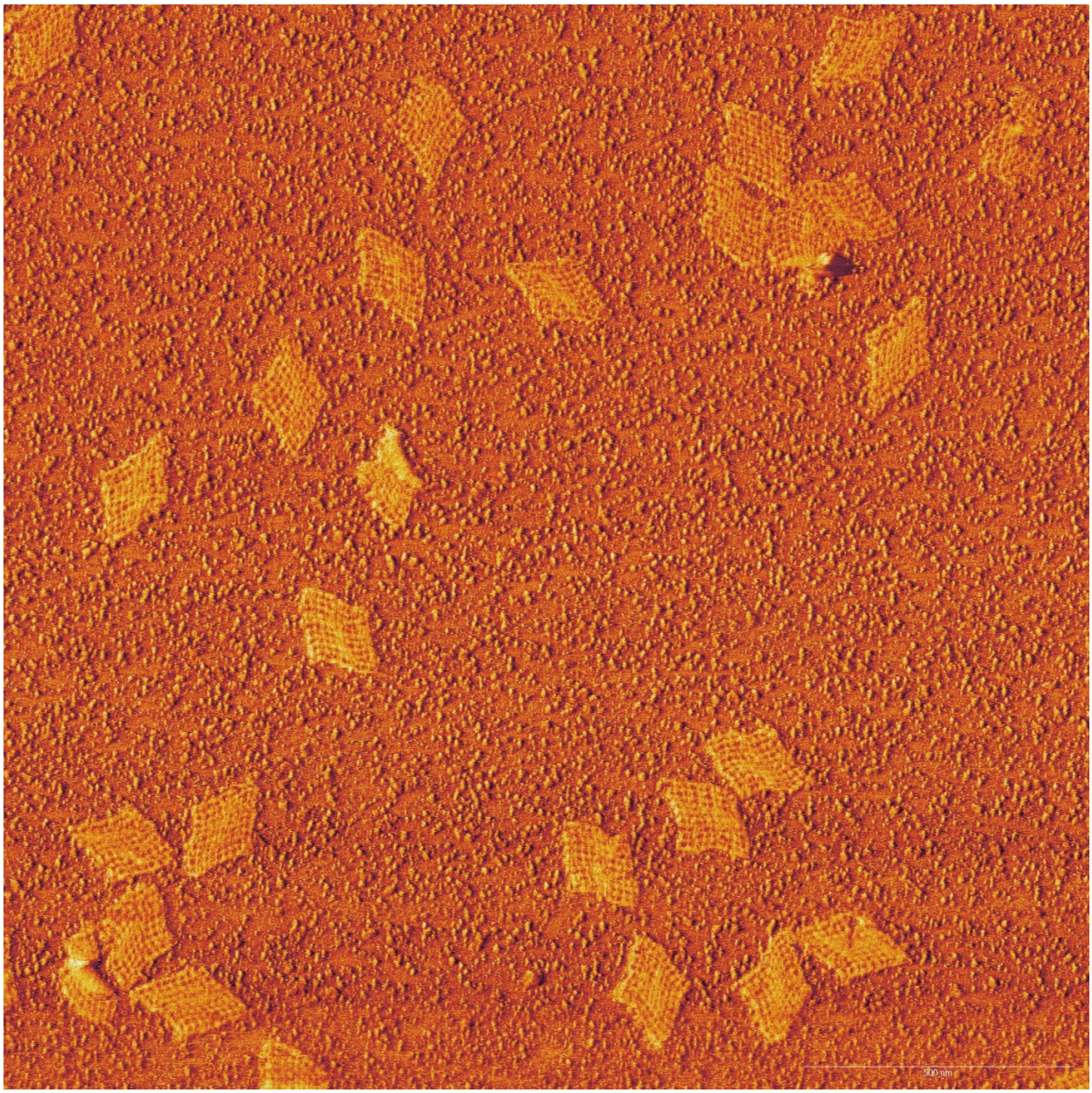
Supplementary figure 6. Estimation of folding yield from AFM. Example image of 3-tesselation structure. Structures where all features of the design appear to have folded successfully were counted as well-folded (green box). Structures that are fragmented or have holes were counted as misfolded (red box). Structures that did not land flat or overlapped with other structures or appeared to be damaged by scanning were not counted. Result of folding yield estimation from AFM is given in supplementary table 2.

Supplementary table 2. Folding yield of flat sheets determined from AFM.

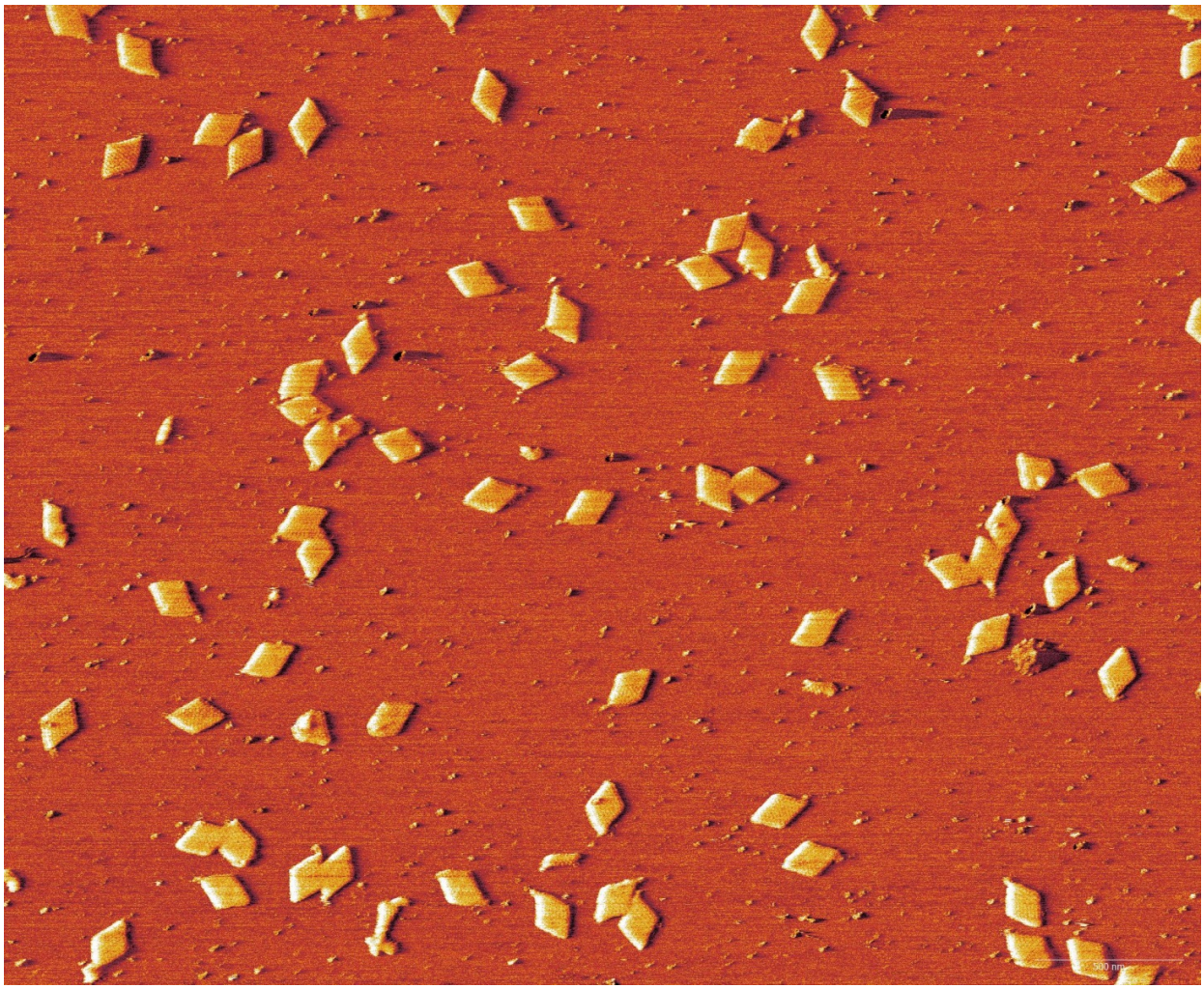
Structure	N**r well folded**	N**r miss-folded**	T**otal nr**	Y**ield**
6-Tesselation	86	72	158	0,54
4-Tesselation	82	39	121	0,68
3-Tesselation	165	12	177	0,93
Ring	95	26	121	0,79
Three-hole disc	96	110	206	0,47
Hand	93	81	174	0,53
Map of Scandinavia	68	60	128	0,53



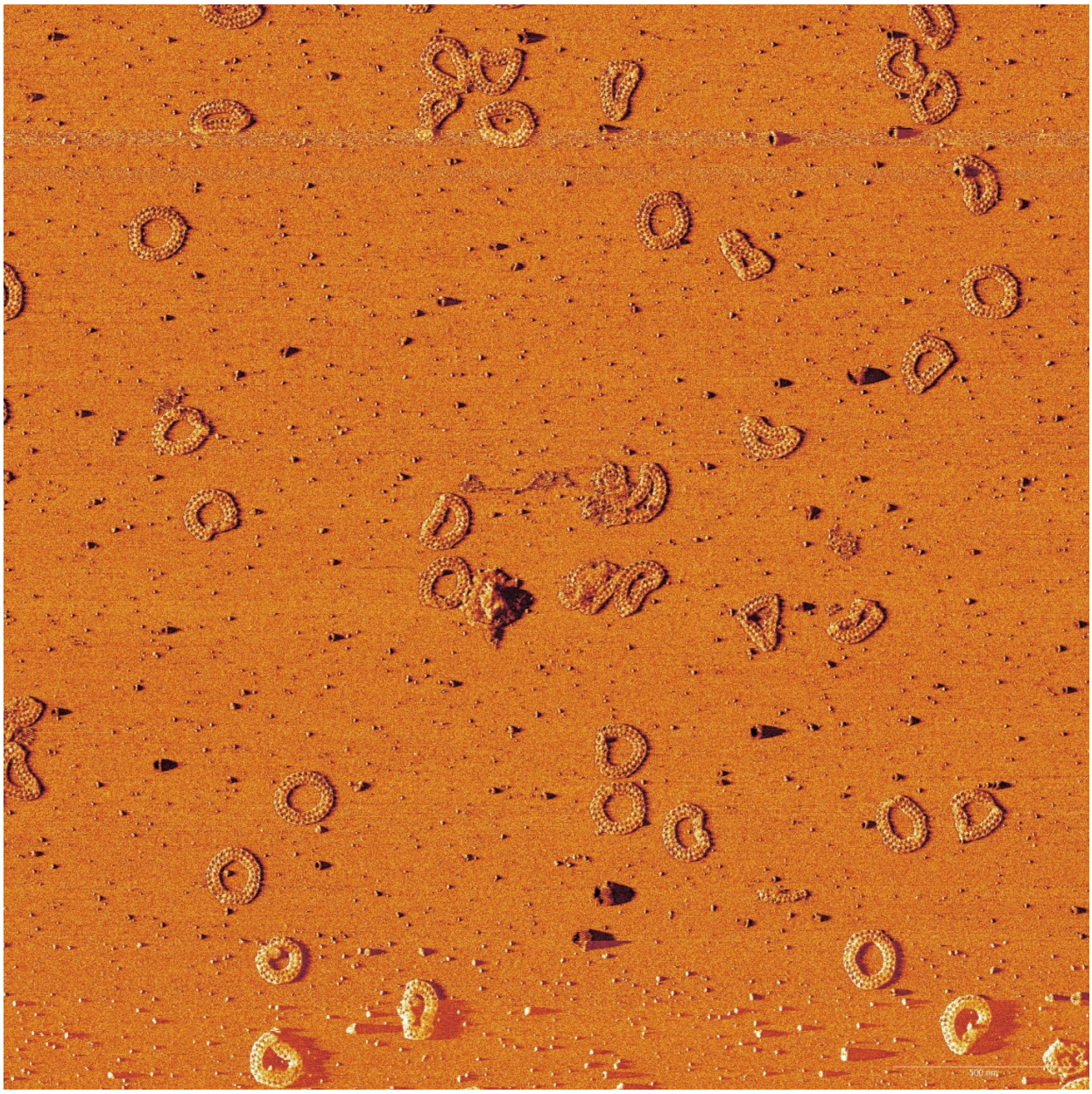
Supplementary figure 7. AFM image of 6-tesselation structure. Scale bar 500 nm



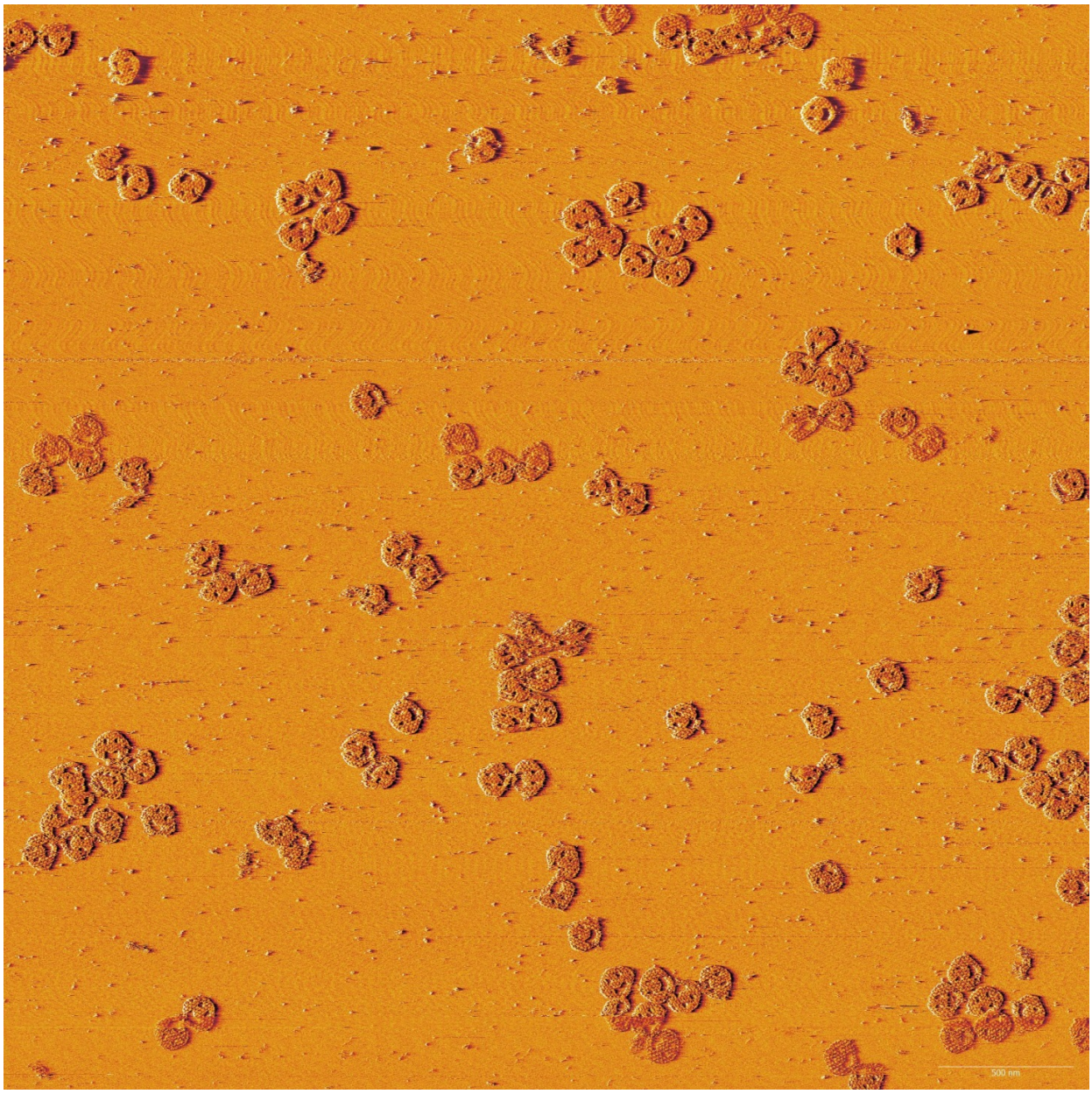
Supplementary figure 8. AFM image of 4-tesselation structure . Scale bar 500 nm



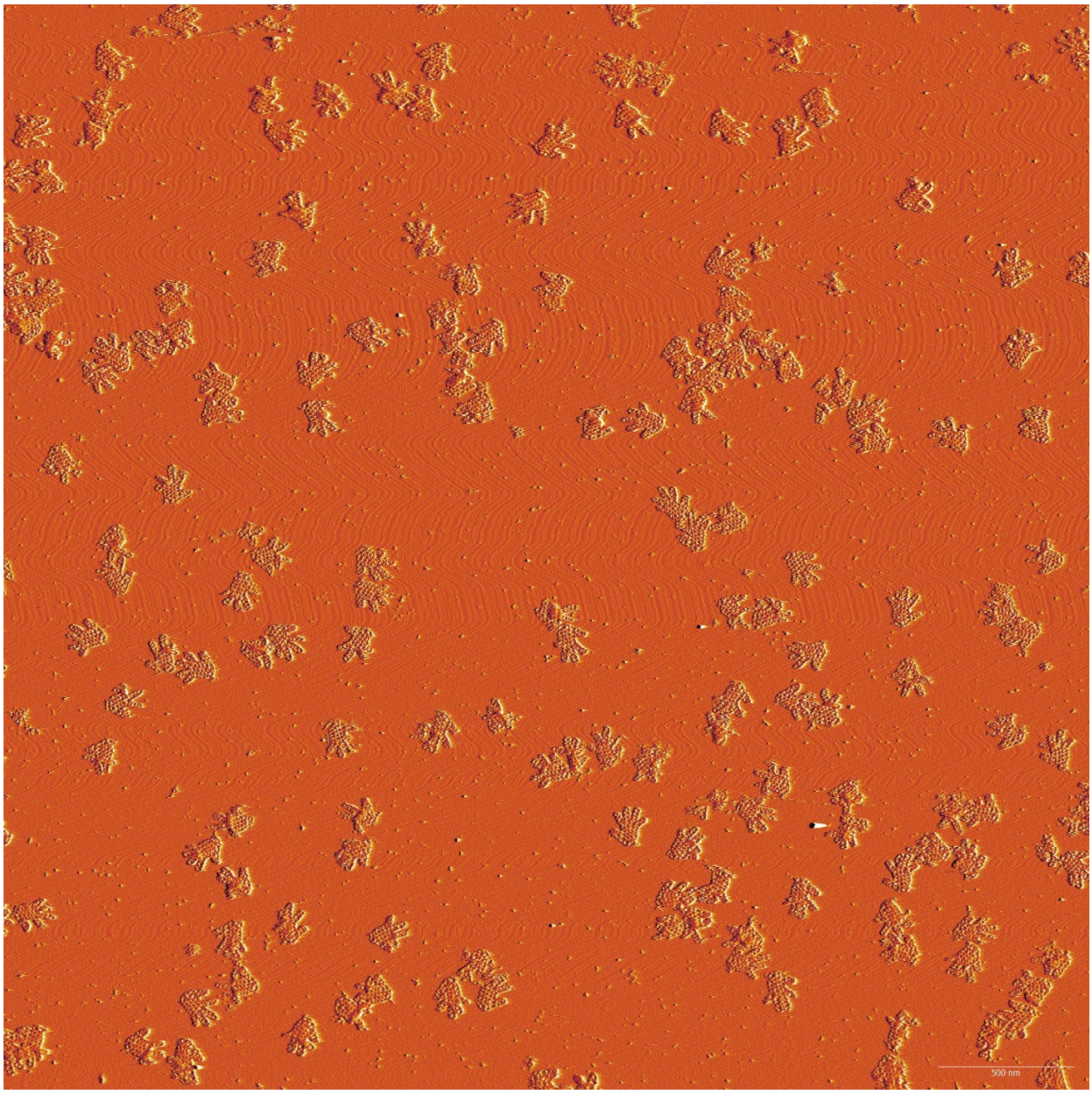
Supplementary figure 9. AFM image of 3-tesselation structure. . Scale bar 500 nm



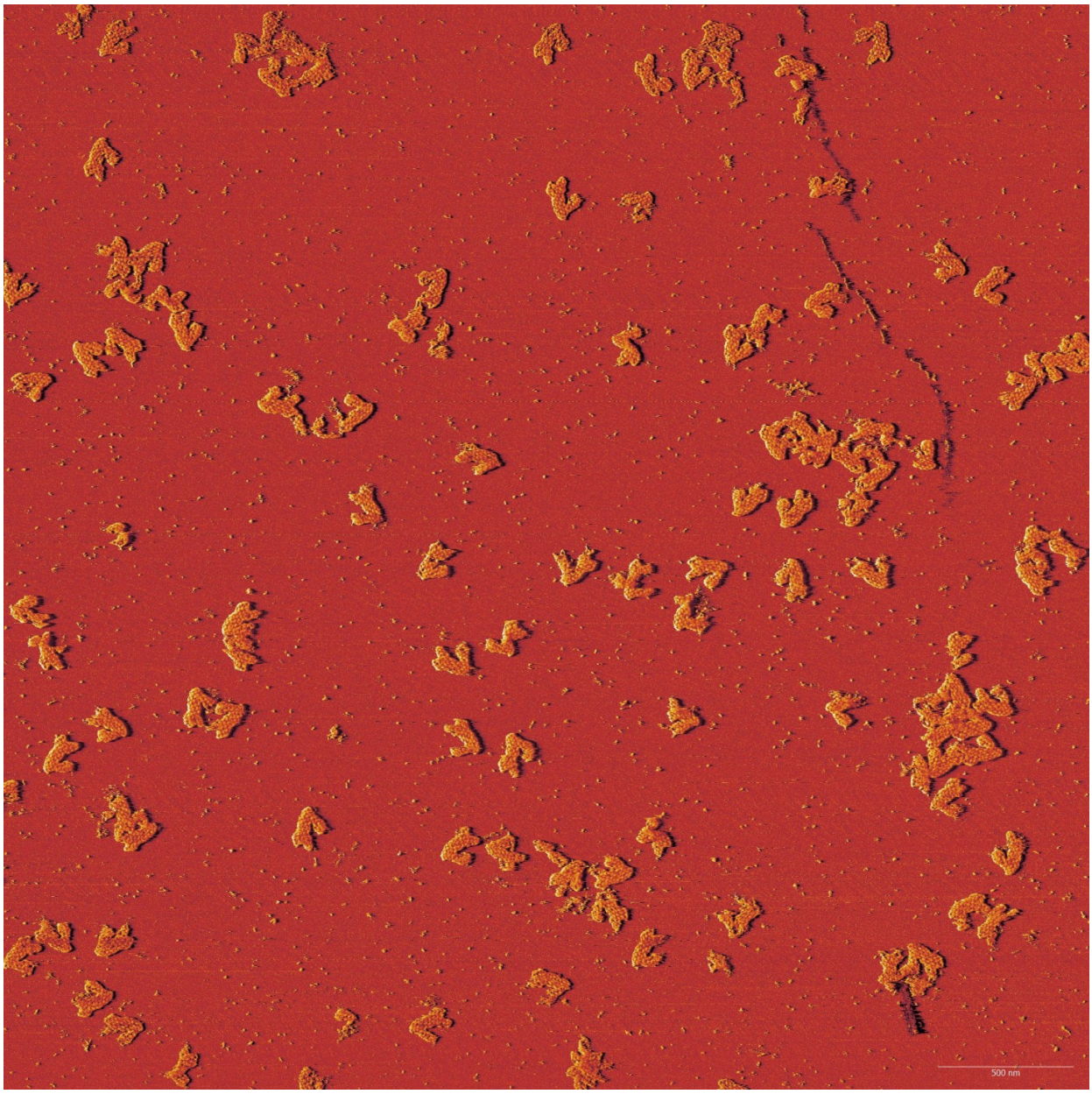
Supplementary figure 10. AFM image of Ring structure. Scale bar 500 nm



Supplementary figure 11. AFM image of Three-hole disc structure. Scale bar 500 nm



Supplementary figure 12. AFM image of Hand structure. Scale bar 500 nm



Supplementary figure 13. AFM image of map of Scandinavia structure. Scale bar 500 nm

Supplementary table 3. Staple strand sequences for folding the 6-tesselation flat sheet.

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TTCCTGTAGCCAGCTTTCATCAACATTAAATGTGAGCGAGTA
ACCAATAGGAACGCCATCAAAAATAATTCGCGTCTGGCC
AATTACGAGGCATAGTAAAAATCAGCTCATTTTTTA
GCATTAAATTTTTGTTAGAGCAACACTATCATA
ACCCTCGTTTACCAGAATATTTTGTTAAAATTC
TTAAATTGTAAACGTTAACGACGATAAAAACCAAAAT
AGAAAAGCCCCAAAAACAGGAAGATTGTATAAGCAAATAT
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AGGTAAAGATTCAAAAAGCCCGAAAGACTTCAA
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CCAAAAACATTATGACCCTGTAATACTTTTGCGGGAGAA
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ATAATGCTGTAGCTCAAATTAGCAAAATTAAGC
ATACAGGCAAGGCAAAGAACATGTTTTAAATATGCAA
CAATTCTACTAATAGTAGTAGCATTAACATCCAATAAATC
TAGCTATATTTTCATTTGGGGCGCGAGCTGAAAAGGTGGCAT
TTTGACCATTAGATACATTTCGCAAATGGTCAATAACCTGTT
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AACAGTTGATTCCCAAACTTTTTCATGAGGAA
GTTTCCATTAAACGGGAAAGTTTCATTCCATAT
CTAAAGTACGGTGTCTGGTAAAATACGTAATGCCACT
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GAGTACCTTTAATTGCCAAAGTACAACGGAGA
TTTGTATCATCGCCTGACAGGTCAGGATTAGA
GACCGGAAGCAAACTCCAATAAATTGTGTCGAAATCC
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AGCGAGAGGCTTTTGCAAGTTTAATTTCAACTTTAAT
CTACGTTAATAAAACGAAGATACATAACGCCAAAAGG
CCACATTCAACTAATGCAACTAACGGAACAACATTATT
ACCGTAATGGGATAGGTCCAGTTGAGATTTAGGAATA
ACAGGTAGAAAGATTCATACGTTGGTGTAGATGGGCG
GCCCGGAATAGGTGTATCGGACGTTGGGAAGAAAAAT
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ACACTGAGTTTCGTCACCGCTCATTCAGTGAATAAGG
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CCTGTAGCATTCCACAATATTCATTACCCAAA
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AAAGTTACCAGAAGGAAATCAGAGCCACCACCCTCAG
CTCAGAACCGCCACCCCCGAGGAAACGCAATA
ATAACGGAATACCCAACCTCAGAGCCGCCACC
CACCACCGGAACCGCCTCAAGAACTGGCATGATTAAG
ACGCAAAGACACCACGGATGTAGCGCGTTTTCATCGG
GCCTTTAGCGTCAGACAATAAGTTTATTTTGTC
ACAATCAATAGAAAATCGACAGAATCAAGTTT
CAGCACCGTAATCAGTAGTCATATGGTTTACCAGCGC
GTGAATTATCACCGTCACCGACTTGAGCCATTTGGGAATTAG
TGAGGAAGGTTATCTAAAATAGACGGAAATTATTCATTAAAG
GAGGGAAGGTAAATATTCTTTAGGAGCACTAA
CAACTAATAGATTAGAAATTCAACCGATTGAGG
CAAAGACAAAAGGGCGACAGCCGTCAATAGATAAT
TTACCTTTTTTAATGGAAGTGGCAACATATAAAAGAA
AAATACATACATAAAGACAGTACATAAATCAA

TATATGTGAGTGAATATGTTAGCAAACGTAGA
ACTCCTTATTACGCAGTAAACCTTGCTTCTGTAAA
AGATAAGTCCTGAACAAGAGTAAGCAGATAGCCGAAC
AGCCCTTTTTAAGAAAAAAAAATAATATCCCAT
CCTAATTTACGAGCATATAGCTATCTTACCGA
AGAAACAATGAAATAGCAGTAGAAACCAATCAATAAT
CCGTTTTTATTTTCATCGAACACCCTGAACAAAGTCA
ACGGGAGAATTAACTGTAGGAATCATTACCGC
GCCCAATAGCAAGCAACAGGGAAGCGCATTAG
GAGAGAATAACATAAAAAATCAGATATAGAAGGCTTA
CAAGATTAGTTGCTATTTACAAAATAAACAGCCATAT
GAGCCTAATTTGCCAGTTATGCACCCAGCTACAATTTT
AGCGCCATTCGCCATTCAGCTAACGAGCGTCTTTCCA
ATCCTGAATCTTACCAACGGCTGCGCAACTGTTGGGA
GGTGGTTCCGAAATCGGCAGGTTTTGAAGCCTTAAAT
ACCTCCCGACTTGCGGAAAAATCCCTTATAAAT
CAAAAGAATAGCCCGAACGAGGCGTTTTAGCGA
TCCGGTATTCTAAGAACGGATAGGGTTGAGTGTTGTT
CAGGGCGATGGCCCACTACTCATCGAGAACAAGCAAG
TTAAACCAAGTACCGCCGTGAACCATCACCCAAAT
TTATACAAATTCTTACCAATTCCAAGAACGGGTA
CGGCTGTCTTTCCTTATCGTATAAAGCCAACGCTCAA
GCCAGTAATAAGAGAATAGCGCCTGTTTATCAACAAT
GTTCAGCTAATGCAGAACATAAAGTACCGACAAAAGGT
TCGTCGCTATTAATTACGACGACAATAAACAACAT
AAAGTAATTCTGTCCAGATTTTCCCTTAGAATCCTTG
TGGGTTATATAACTATATTAGGCAGAGGCATTTTCGA
AACGCCAACATGTAATGTAAATGCTGATGCAAATC
ATAATTACTAGAAAAAGCAAATCGCCATATTTAAC
CAGTAGGGCTTAATTGAGCTGTTTAGTATCATATGCG
CTTGACGGGGAAAGCCGGAAGAATAAACACCGGAATC
TAAATAAGGCGTTAAACGAACGTGGCGAGAAAGGA
ATCAGAGCGGGAGCTAAAAATACCGACCGTGTGA
TAAATTTAATGGTTTGACAGGAGGCCGATTAAA
GGGATTTTAGACAGGAATTTCATCTTCTGACC
CAAATATATTTTAGTTACGGTACGCCAGAATCCTGA
TCTGAGAGACTACCTTACGCGAGAAAACTTTTT
CAATCGCAAGACAAAGAATTTAACCTCCGGCTTAGGT
GAAATTGCGTAGATTTATTATCAAAATCATAGG
AAGAGTCAATAGTGAAACAGGTTTAACGTCAGA
TGAATATACAGTAACAAGATTAAGACGCTGAG
AAAACATAGCGATAGCTTTACCTTTTACATCGGGAGA
GTTACAAAATCGCGCAGATTTAACAATTTCATTTGAA
AAAACAAAATTAATTACAAGGCGAATTATTCATTTCAA
ACATTTGAGGATTTAGTGATGAAACAAACATCAAG
TTACCTGAGCAAAAGAAGAAGTATTAGACTTTACAAA
GGAATTATCATCATATTCTGATTGCTTTGAATACCAA
AACAATAACGGATTCGCCACTGATTATCAGATGATGGC
TTTGATTAGTAATAACATAGTAAAACAGAAATAAA
ATCAAAATTATTTGCAAACTTGCCTGAGTAGAA
GAACTCAAACTATCGGGGTTAGAACCTACCAT
CTTCTGAATAATGGAAACTTGCTGGTAATATCCAGA
TCATTTTGCGGAACAAAGATTGTTTGGATTATA
AATTCATCAATATAATCCAGAAACCACCAGAAGGAGC
AAAAGGGACATTCTGGCCAGTTTGAGTAACATTA
ACGTTATTAATTTTAAACAGAGATAGAACCCTTCT

ACAGTGCCACGCTGAGAGTAAATCCTTTGCCCGA
CAATTCGACAACTCGTATCAGCAGCAAATGAAAAATC
ATCAATATCTGGTCAGTTGGCAAATCAACAGTTGAAAGGAAT
TAAAACAGAGGTGAGGCGGTCACCTCAAATATCAAACCCTCA
TAAAGCATCACCTTGCTGAAGTATTAACACCGCCTGCA
AACATCGCCATTAAAAATACCGAACGAACCACCAGCAGAAGA
TGAATGGCTATTAGTCTTTAATGCGCGAACTGATAGCCCTAA
TTATTTACATTGGCAGATTCAACGTGGCACAGACAATATTTT
GACCTGAAAGCGTAAGAACAGTCACACGACCAGTAAT
ATGGAAATACCTACATTTTGACGCTCAATCGTCTGAAATGGA
ACAATATTACCGCCAGCCATTGCAACAGGAAAAACGCTC
GTCTGTCCATCACGCAAATTAACCGTTGTAGCAATACTTC
GAAGTGTTTTTATAATCAGTGAGGCCACCGAGTAAAAGA
TTGCTTTGACGAGCACGTATAACGTGCTTTCCTCGTTAGA
ACCCGCCGCGCTTAATGCGCCGCTACAGGGCGCGTACTATGG
ACCTCGATAAAGACGGAGACACGCTGCGCGTAACCACCAC
CTGGCAAGTGTAGCGGATCCCCGGGTACCGAGCTC
AAATCGGAACCCTAAAAAAGCGGGCGCTAGGGCG
AGGGAAGAAAGCGAAAGGAGGGAGCCCCCGATTTAGAG
TGGACTCCAACGTCAAAGGTGCCGTAAAGCACT
CAAGTTTTTTGGGGTCGAAGGGCGAAAAACCGTCTAT
ACGAGCCGGAAGCATAAACCACTATTAAAGAACG
CCAGTTTGGAACAAGAGTTGTAAAGCCTGGGGTGCCT
TCACCAGTGAGACGGGGGCGAAAATCCTGTTTGAT
CGCTGGTTTGCCCCAGCACAACAGCTGATTGCCCTTC
CTGGCGAAAGGGGGATGTAAGTTGCAGCAAGCGGTCCA
ACCGCCTGGCCCTGAGAGGCTGCAAGGCGATTAAGTT
ACTGCCCGCTTTCCAGTCAGGGTGGTTTTTCTTT
GTTTGCGTATTGGGCGCCAGGGAAACCTGTCGTGCCAG
CAGTGCGGCCCTGCCATCCAACGCGCGGGGAGAGGCG
CTGCATTAATGAATCGGCAGTAAGCAACTCGTCGGTGG
TGAAATTGTTATCCGCCATTAATTGCGTTGCGCTC
AATGAGTGAGCTAACTCATCACAATTCCACACAACAT
AATGAGTAAACAGGGCTTAATAGCTGTTTCCTGTG
GAATTCGTAATCATGGTCAAAAGCTACGTGGTGCTTGTT
CATAAATCATTTCTCCGAACTCTGACCTCCTGGTTGGTGT
GCACGAATATAGGGGCCTTGAATCGGCTGACGCATTTCA
CGACGGCCAGTGCCAAGCTGGAAGTGACTCTATGATACCGA
GGGTAACGCCAGGGTTTTCCCAGTCACGACGTTGTAAAA
AGGGCGATCGGTGCGGGCACTCTTCGCTATTACGCCAG
CTTTCCGGCACCGCTTCTAGGTGCCGGAAACCAGGCAA
CATCGTAACCGTGCATCTAGCCAGTTTGAGGGGACGAC

Supplementary table 4. Staple strand sequences for folding the 4-tesselation flat sheet.

AAAGGCTATCAGGTCATTGCCAATTTTGTTAAAATTCGCATTA
CATCAACATTAAATGTGAATAGCTATTTTTGAGAGATCTAC
TGATAAATTAATGCCGGAGAGGCGAGTAACAACCCGTCGGAT
TCTCCGTGGGAACAAACGGCGTATGATATTCAACCGTTCTAGC
CCGGAGACAGTCAAATCACCATCAAGATTGACCGTAATGGGATAGG
GGGCGGTTGTGTACATCGAAAAAGATTCAAAAGGGTGAGAAAGG
AATGCCTGAGTAATGTGTAGGACATAAAAAAATCCCGTAAAA
AAAGCCGCACAGGCGGCCTTTACCCTCATATATTTTAAATGC
CAACGCAAGGATAAAAATTTTTAGAAGTGATGAAGGGTAAAGTTAA
CGGTTTGCGTATTGGGCGAACTTTTGCGGGAGAAGCCTTTATTT
AAAACATTATGACCCTGTAATCCAGGGTGGTTTTTCTTTTCA
CCAGTGAGACGGGCAACAGCTAAAGCTAAATCGGTTGTACCA
TTAAGCAATAAAGCCTCAGAGCATAGATTGCCCTTCACCGCCTGGC
AAATATCAAACCCTCAATAAAGGCAAGGCAAAGAATTAGCAAAA
TTAACATCCAATAAATCATACCAATATCTGGTCAGTTGGCAA
ATCAACAGTTGAAAGGAATTGAATTCTACTAATAGTAGTAGCA
GCGCGAGCTGAAAAGGTGGCAAGGAAGGTTATCTAAAATATC
TTCGCAAATGGTCAATAACCTTTTAGCTATATTTTCATTTGGG
GGCTTATCCGGTATTCTAAGATAGTTTGACCATTAGATACAT
CCAATTCTGCGAACGAGTAGAACGCGAGGCGTTTTAGCGAAC
CTCCCGACTTGCGGGAGGTTTATTCCATATAACAGTTGATTC
CTAAAGTACGGTGTCTGGAAGTTTATGAAGCCTTAAATCAAGAT
AAGCGCAGTCTCTGAATTTACAAGCTCAACATGTTTTAAATATGCAA
AATTGCTGAATATAATGCTGTCGTTCCAGTAAGCGTCATACA
TGGCTTTTGATGATACAGGAGTTTTGCGGATGGCTTAGAGCTT
TTGCTCCTTTTGATAAGAGGTCAATGTACTGGTAATAAGTTTT
TTGAGGACTAAAGACTTTTTCAAGTCAGGATTAGAGAGTACCTTTAA
GACCGGAAGCAAACTCCAACAATGAGGAAGTTTCCATTAAAC
GGGTAAAATACGTAATGCCACTTCGAGCTTCAAAGCGAACCA
AAGACTTCAAATATCGCGTTTTAAATACGAAGGCACCAACCTAA
ACGGAACAACATTATTACAGGAACAAAAAGATTAAGAGGAAGCCCGA
TCAGAAGCAAAGCGGATTGCATAGAAAGATTCATCAGTTGAG
ATTTAGGAATACCACATTCAAGTCTTTACCCTGACTATTATAG
AATGACCATAAATCAAAAATCACTAATGCAGATACATAACG
TCATTGAATCCCCCTCAAATTTTAAACAGTTCAGAAAACGAG
ATAACCCTCGTTTACCAGCTGCGGAATCGTCATAAATAT
GTTTAGACTGGATAGCGTCCAATACGACGATAAAAACCAAAATAGCG
GCTTGCCCTGACGAGAAACACATGCCAGAGGGGGTAATAGTAAAAT
AGAGGCTTTTGCAAAAGAAGTTTGAACGAGTAGTAAATTGGG
ACCTTATGCGATTTTAAGATAGTAAGAGCAACACTATC
CCAAAAGGAATTACGAGGACTGGCTCATTATACCAGTC
TTGACCCCCAGCGATTATCTACGTTAATAAAACGAACTA
AGGACGTTGGGAAGAAAAACCAAGCGCGAAACAAAGTA
AAATCCGCGACCTGCTCCAACTTTAATCATTGTGAATT
CTTGAGATGGTTTAATTTAAGTTACTTAGCCGGAACGAG
TTTGAAAGAGGACAGATGAAGCTGCTCATTCAGTGAATAAG
CATTACCCAAATCAACGTAACAAAACGGTGTACAGACCAGGCGCATA
TTTCAGCGGAGTGAGAATAGAATAATCTTGACAAGAACCGGATATT
GGCTGGCTGACCTTCATCAAGAGGGAACAACTAAAGGAATTG
AGGCTCCAAAAGGAGCCTAAGGGAACCGAACTGACCAAC
GCGCAGACGGTCAATCATAAATTGTATCGGTTTATCAG
GATAGTTGCGCCGACAATACGCCTGATAAATTGTGTCG
CAACGGAGATTTGTATCAAACAACAACCATCGCCCACG
TAAAGGCCGCTTTTGCGGATACACTAAAACACTCATCT

AACGAAAGAGGCAAAAGAAATCGTCACCCTCAGCAGCGA
CAGTTAATGCCCCCTGCCAGTAGCAACGGCTACAGAGGCT
AAGACAGCATCGGAACGAAATTTCGGAACCTATTATTC
AGAAGGATTAGGATTAGCAGCTGAGGCTTGCAGGGAGT
CATAACCGATATATTCGGAGGGTTTTGCTCAGTACCAG
CCCGGAATAGGTGTATCAATCTTAAACAGCTTGATACC
CTTGCTTTCGAGGTGAATACGTACTCAGGAGGTTTAGT
CTCAGAGCCACCACCCTCATTGAAAATCTCCAAAAAAA
CGAATAATAATTTTTTCAAATTTCAGGGATAGCAAGCCC
AGTACAAACTACAACGCCAATTGCTAAACAACTTTCAACAG
TAAATGAATTTTCTGTATGGGATTGTAGCATTCCACAGACAGCCCTC
TAAATATTGACGGAAATTATTATTTTGTCGTCTTTCCAGACGTTAG
ATAGTTAGCGTAACGATCTAAAGTTAAAGGTGAATTATCACC
ATCACCAGTAGCACCATTAAAACACTGAGTTTCGTCACC
AATAGGAACCCATGTACCACATTAGCAAGGCCGGAAAC
TAGCGACAGAATCAAGTTACACCCTCAGAACCGCCACC
ACCGCCACCCTCAGAACCAGCCTTTAGCGTCAGACTGT
ATTAGCGTTTGCCATCTTAAGGGTTGATATAAGTATAG
GCGGATAAGTGCCGTCGAATCATAATCAAAATCACCGG
CCACCCTCAGAACCGCCAAGAGGCTGAGACTCCTCAAG
TGAAACATGAAAGTATTAACCTCAGAGCCACCACCCTC
ATTGACAGGAGGTTGAGGAAGTAACAGTGCCCGTATAAA
AACGGGGTCAGTGCCTTGAGGTCAGACGATTGGCCTTG
ATCTTACCAACGCTAACGCCTCATTAAAGCCAGAATGGA
ATATTCACAAACAAATAAAGCGTCTTTCCAGAGCCTAA
CAATCCAAATAAGAAACGACACCAGAGCCGCCGCCAGC
AGAGCCGCCACCAGAACCATTTTTTGTTTAACGTCAAA
AACAGGGAAGCGCATTAGAACCGCCTCCCTCAGAGCCG
AACCAGAGCCACCACCGGACGGGAGAATTAACTGAACA
AGAGAGATAACCCACAAGATTTCGGTCATAGCCCCCTT
AGCGCGTTTTCATCGGCAAATTGAGTTAAGCCCAATAA
CCGAAGCCCTTTTTAAGAAATAGCAGCACCGTAATCAG
GTCACCAATGAAACCATCAAAGTAAGCAGATAGCCGAA
CGGAATACCCAAAAGAACAGGGAATTAGAGCCAGCAAA
GTCACCGACTTGAGCCATAGCATGATTAAGACTCCTTA
AAGGTGGCAACATATAAAAAAACCGATTGAGGGAGGGAAGG
GCCAAAGACAAAAGGGCGACATTAGAAACGCAAAGACACCACGGAAT
TATGTAAATGCTGATGCAAATAAGAAAATTCATATGGTTTACCAGC
AAGTTTATTTTGTCACAATCAATCAATCGCAAGACAAAGAAC
TCTTCTGACCTAAATTTAAACGTAGAAAATACATACATA
TTACGCAGTATGTTAGCAAGGTTTGAAATACCGACCGT
CATAATTACTAGAAAAAGACGAGGAAACGCAATAATAA
CAAAGTTACCAGAAGGAAACTGTTTAGTATCATATGCG
AGTAGGGCTTAATTGAGAAAATAGCAATAGCTATCTTA
TAAGAGCAAGAAACAATGATCGCCATATTTAACAACGC
ATAAGAGAATATAAAGTAAGTAATTGAGCGCTAATATC
CCCTGAACAAAGTCAGAGACGACAAAAGGTAAAGTAAT
ATGCAGAACGCGCCTGTTAACAGAGAGAATAACATAAA
AATGAAAATAGCAGCCTTAATCAACAATAGATAAGTCC
ATGTAGAAACCAATCAATAACAGCCATATTATTTATCC
TTTGCCAGTTACAAAATAAATCGGCTGTCTTTCCTTAT
CGAGAACAAGCAAGCCGTAAGCTACAATTTTATCCTGA
TAGTTGCTATTTTGCACCAATTTATTTTCATCGTAGGAA
TTTAGGAGCACTAACAACTAAGCAAGCAAATCAGATATAGAA
TCATTACCGCGCCCAATAAAGATTAGAGCCGTCAATAG
ACAATTCGACAACTCGTAAAACCAAGTACCGCACTCAT

CATTCCAAGAACGGGTATAAAATCCTTTGCCCGAACGT
GGAACAAAGAAACCACCAACCCATCCTAATTTACGAGC
TGAACAAGAAAAATAATAAAAGGAGCGGAATTATCATC
AATCCTGATTGTTTGGATATAAACAACATGTTCAGCTA
TCTGTCCAGACGACGACAAATACTTCTGAATAATGGAA
AACAGAAATAAAGAAATTAAGGCATTTTCGAGCCAGTA
CAACATGTAATTTAGGCAACGTAGATTTTCAGGTTTAA
GGAGAAACAATAACGGATATATAAAGCCAACGCTCAAC
TTATACAAATTCTTACCAACGCCTGATTGCTTTGAATA
CAATTACCTGAGCAAAAGATAAGAATAAACACCGGAAT
GTGATAAATAAGGCGTTAAGATGATGAAACAAACATCA
TTACCTTTTTTAATGGAAATATATTTTAGTTAATTTCA
GCGAGAAAACTTTTTCAAAACAGTACATAAATCAATATATG
ACTACCTTTTTAACCTCCGGCAATTAGGTTGGGTTATATAACTA
TGAGTGAATAACCTTGCTTCTATCAAAATCATAGGTCTGAGAG
TGAGAAGAGTCAATAGTGAATTTAGTAAATCGTCGCTATTAATTAATT
CTGAGAAGTGTTTTTATAATCATAGCGATAGCTTAGATTAAGACGC
TTCCCTTAGAATCCTTGAAAACAGTGAGGCCACCGAGTAAAAGA
GTCTGTCCATCACGCAAATTAATTTAACAATTTCATTTGAA
AGAAAACAAAATTAATTAACCGTTGTAGCAATACTTCT
TCAAACTATCGGCCTTGCAAGAGGCGAATTATTCATTT
CCAAGTTACAAAATCGCGAGGTAATATCCAGAACAATA
AATACCTACATTTTGACGAAACAGTACCTTTTACATCG
CGTCAGATGAATATACAGATCAATCGTCTGAAATGGAT
ATAAAAGGGACATTCTGGACAAAATTATTTGCACGTAA
GGGTTAGAACCTACCATAACAACAGAGATAGAACCCTT
TTTTTGAATGGCTATTAGAGATGGCAATTCATCAATAT
ATATTCCTGATTATCAGAACTTTAATGCGCGAACTGAT
ACCAGCAGAAGATAAAACAAGTAACATTATCATTTTGC
TATTAATTTTAAAAGTTTAGAGGTGAGGCGGTCAGTAT
GCAAATGAAAAATCTAAAAGAAGTATTAGACTTTACAA
ATAATACATTTGAGGATTAACATCACCTTGCTGAACCTC
CCTGAGAGAGTTGCAGCAAGCAGCCACGCTGAGAGCCAGCA
TAACACCGCCTGCAACAGAGTCCACGCTGGTTTGCCCC
GCAAAATCCCTTATAAATATAAAAATACCGAACGAACC
AGCCCTAAAACATCGCCAAAAAGAATAGCCCGAGATAG
TTAAAGAACGTGGACTCCAATACGTGGCACAGACAATA
CTGACCTGAAAGCGTAAGAACGTCAAAGGGCGAAAAAC
CCAAATCAAGTTTTTTGGAACCAGTCACACGACCAGTA
TATTTACATTGGCAGATTAGTCGAGGTGCCGTAAAGCA
TTGACGGGGAAAGCCGGCACAGGAAAAACGCTCATGGA
TTACCGCCAGCCATTGCAAACGTGGCGAGAAAGGAAGG
TGTAGCGGTCACGCTGCGACTTGCCTGAGTAGAAGAAC
TTGATTAGTAATAACATCAATAACCACCACACCCGCCGCGC
TTAATGCGCCGCTACAGGGCGACAGGAACGGTACGCCAGAATC
GAGGCCGATTAAAGGGATTTTAGACGTACTATGGTTGCTTTGACGAGC
CTGCATCAGACGATCCAGCGCAAGAATCAGAGCGGGAGCTAAACAG
ACGTATAACGTGCTTTCCTCGTTAGTGTCACTGCGCGCCTGTGC
ACTCTGTGGTGCTGCGGCCAGAGCGCTAGGGCGCTGGCAAG
GAAGAAAGCGAAAGGAGCAATGCGGCGGGCCGTTTTCA
TCTTCGCGTCCGTGAGCCAGGAGCCCCCGATTTAGAGC
CTAAATCGGAACCCTAAAACCTCACAGTTGAGGATCCC
GTTTCCTGTGTGAAATTGACCACTACGTGAACCATCAC
CGTCTATCAGGGCGATGGAATCCGCTCACAATTCCACA
GTGCCTAATGAGTGAGCTATTGGAACAAGAGTCCACTA
GGTTGAGTGTTGTTCCAGAACTCACATTAATTGCGTTG

CCAGCTGCATTAATGAATAGATGGTGGTTCCGAAATCG
AGCAGGCGAAAATCCTGTAAGCCAACGCGCGGGGAGAGG
ACGATGCTGATTGCCGTTCCGAAGTCGGGAAACCTGTCGTG
CGCTCACTGCCCGCTTTCACAAACGCGGTCCGTTTTTT
ATAACGGAACGTGCCGGAAATAAAGTGTAAAGCCTGGG
CAACATACGAGCCGGAAGATGTAGAACGTCAGCGTGGT
CAGCACCGTCGGTGGTGCACGTAATCATGGTCATAGCT
CGGGTACCGAGCTCGAATATCCCACGCAACCAGCTTAC
CTTTCGCACTCAATCCGCATGCCAGCACGCGTGCCTGT
CGGTCATACCGGGGGTTTAAGGCGCGGTTGCGGTATGAGCC
GGGTCACTGTTGCCCTGCGGCAAGCCAGCGGTGCCGGTGCCCC
GGCATCAGATGCCGGGTTACCTGATGGTAATGGGTAAAGGTTTCTTTG
TTTCCCAGTCACGACGTTGTAATGGTGTGTTCAGCAAATCGTTAAC
CTCGTCATAAACATCCCTTACACAACGACGGCCAGTGCCAAGCT
TTCAGAGGTGGAGCCGCCACGAAGCGGGGTCATTGCAGGCG
GGCTGGAGGTGTCCAGCAAGAACGGATAACCTCACCGG
CCCGGAATTTGTGAGAGAAACCGCAAGAATGCCAACGG
GCTGGTCTGGTCAGCAGCAAGACTTTCTCCGTGGTGAA
GATCAAACTTAAATTTCTACCGGCCAGAGCACATCCTC
CGTCTCGTCGCTGGCAGCAATCATTTGCCGCCAGCAGTT
TCACGTTGGTGTAGATGGGCGAAGAGACGCAGAAACAGCG
GGGATAGCTCTCACGGAAAATCGTAACCGTGCATCTGC
TCGCACTCCAGCCAGCTTACAGCGCCATGTTTACCAGT
AAACAATCGGCGAAACGTAACGGCACCGCTTCTGGTGCCGG
AAACCAGGCAAAGCGCCATTCATAAGTTGGGTAACGCCAGGGT
AAGGGGGATGTGCTGCAAGGCGAAGCCATTCAGGCTGCGCAACTGTTG
AATTTTTGTTAAATCAGCTCAACTTCGCTATTACGCCAGCTGGCGA
GGAAGGGCGATCGGTGCGGGCCTTTTTTAACCAATAGGAACGCC
ATCAAAAATAATTCGCGTCTGAAGTATCGGCCTCAGGAAGA
CAGTTTGAGGGGACGACGACCTTCCTGTAGCCAGCTTT

Supplementary table 5. Staple strand sequences for folding the 3-tesselation flat sheet.

TATCAGGTCATTGCCCGTGCATCTGCCAGTTT
GGGCGAAAAACCGTCTAAGAGAGATCTACAAAGGC
GGAGAGGGTAGCTATTTTAATCAGGGCGATGGCCCA
GAGGGGACGACGACAGTAGCTGATAAATTAATGCC
ATATGATATTCAACCGTTTATCGGCCTCAGGAAGATC
GGAAACCAGGCAAAGCGCGACAGTCAAATCACCATCA
AAAAGGGTGAGAAAGGCCCATTCGCCATTCAGGCTGC
GCTATTACGCCAGCTGGCAAATGTGTAGGTAAAGATTC
TTTAAATGCAATGCCTGAAAGGGGGATGTGCT
ATAAGGGAACCGAACTAAAAATTAGAACCCTCATATAT
AACGCAAGGATAAAAATTGACCAACTTTGAAAGA
GCAAGGCGATTAAGTTCGGGAGAAGCCTTTATTTC
GACCCTGTAATACTTTTGCGGCGAAACGTACAGC
GGACAGATGAACGGTGGTTGTACCAAAAACATTAT
GAGCATAAAGCTAAATCGAAGGCTTGCCCTGACG
GCCATGTTTACCAGTCATTAAGCAATAAAGCCTCA
AGGCAAAGAATTAGCAAACAGCAGTTGGGCGGTT
AGAAACACCAGAACGACCAATAAATCATACAGGCA
TAGTAGTAGCATTAACATAAAATCTACGTTAATA
GTGTACATCGACATAAGTGGCATCAATTCTACTAA
GGGGCGCGAGCTGAAAAGCGCTGGCAGCCTCCGG
AAACGAACTAACGGAATTTAGCTATATTTTCATTT
CAAATGGTCAATAACCTGAACACTATCATAACCC
CCAGAGCACATCCTCAGACCATTAGATACATTTCG
GAACGAGTAGATTTAGTTTCCAGCTTACGGCTGGA
TCGTTTACCAGACGACAGTTGATTCCCAATTCTGC
AGTTTCATTCCATATAACATATAATGCTGTAGCTCAA
GGTGTCCAGCATCAGCCTAAAGTACGGTGTCTGGA
CATGTTTTAAATATGCAAGAGAGTACCTTTAATTGCT
AGAGCTTAATTGCTGATGGATAGCGTCCAATACTG
TGCTTTAAACAGTTCAGATTTTTGCGGATGGCTT
CCTTTTGATAAGAGGTCAAAATATCGCGTTTTAATTC
CAACAGGTCAGGATTATCATAAACATCCCTTACAC
GGGTTACCTGCAGCCAGCGACCGGAAGCAAACTC
GAGCTTCAAAGCGAACCAGGAACAAAGAAACCAC
GGAAGCCCGAAAGACTTCAAACGAGAATGACCATAAA
CAGAAGGAGCGGAATTTGCATCAAAAAGATTAAGA
CAGAAGCAAAGCGGATATTAATTAATTTTCCCTTA
GCTGAGAAGAGTCAATAGCCCTGACTATTATAGT
TCAAAAATCAGGTCTTTATAATTTTTTCACGTTG
AAAATCTCCAAAAAAATCATTGAATCCCCCTCAAA
CGGAATCGTCATAAATATTCGCCCACGCATAACC
ATAGTAAAATGTTTAGACGATAAAAACCAAAATAGCG
GATATATTCGGTCGCTAGTTTTGCCAGAGGGGGTA
AGAGGCTTTTGCAAAAGACATAACGCCAAAAGGAATT
ACGAGGCATAGTAAGAGCCAACATTATTACAGGTAGA
TCAACTAATGCAGATAAAGACTTTTTCATGAGGAA
GAAGGCACCAACCTAAAATTTAGGAATACCACAT
AAGATTCATCAGTTGAGAGAACTGGCTCATTATACCA
GTCAGGACGTTGGGAAGAGTAGTAAATTGGGCTTGAG
CCTTATGCGATTTTAACGAAAGAGGCAAAAGAATA
CAAGCGCGAAACAAAGTATAATCATTGTGAATTA
ATGGTTTAATTTCAACTTCCCAAATCAACGTAACAAA
GCTGCTCATTCAGTGAATTACAGACCAGGCGCATAGG

AACCGGATATTCATTACAACGGAGATTTGTATCAT
CATGTTACTTAGCCGGGAGTAATCTTGACAAG
CTGGCTGACCTTCATCAAAGCGCAGACGGTCAATC
AGGAGTGTACTGGTAAAAAAAAAATCCGCGACCTGCTC
CGCCTGATAAATTGTGTCTAAGTTTTAACGGGGT
CAGTGCCTTGAGTAACTGACCCCCAGCGATTATAC
CACTAAAACACTCATCTTGCGGGGTTTTGCTCAG
TACCAGGCGGATAAGTAAATACGTAATGCCACTAC
GTTTCCATTAAACGGGTAACGAGGGTAGCAACGGCTA
CAGAGGCTTTGAGGACTAGAGGCTTGCAGGGAGTTAA
GAAAGACAGCATCGGACTCAGAACCGCCACCCTCA
GGATAGCAAGCCCAATAGCGTCACCCTCAGCAGC
AGGCCGCTTTTGCGGGATTTGATACCGATAGTTGCGC
CGACAATGACAACAACCAAGGCTCCAAAAGGAGCCTT
GAATTTCTTAAACAGCGAACCCATGTACCGTAACA
GCATTCCACAGACAGCCCAGCTTGCTTTCGAGGT
TAATTGTATCGGTTTATCGAGAATAGAAAGGAACAAC
TAAAGGAATTGCGAATAAGAATTTATCAAAATCA
CAACAGTTTCAGCGGAGTTCATAGTTAGCGTAACGAT
TAGGTCTGAGAGACTAGATTTTGCTAAACAACTTT
TGAATTTTCTGTATGGAGCAAATCAGATATAGAAG
GAACCTCCCGACTTGCGGTCCAGACGTTAGTAAA
CTAAAGTTTTGTCGTCTTAAGGTAAATATTGACG
GAAATTATTCATTAAAACAAACTACAACGCCTGTA
CTGAGTTTCGTCACCAGTCATCGATAGCAGCACC
GTAATCAGTAGCGACACCACCACCCTCATTTTCAG
GAACCGCCACCCTCAGAGACCAGAGCCACCACCG
AGGTTTAGTACCGCCACCGCCGTCGAGAGGGTTGATA
GAACCGCCTCCCTCAGGTGTATCACCGTACTCAGG
TAAGTATAGCCCGGAATAAAGAGGCTGAGACTCCTCA
AGAGAAGGATTAGGATTAAGTGCCCGTATAAACAGTT
GAAACATGAAAGTATTGATATTCACAAACAAATAA
TACCGTTCCAGTAAGCGTCATCGGAACCTATTATTCT
AATGCCCCCTGCCTATTTATGGCTTTTGATGATAC
CACCACCAGAGCCGCCGCCAGAGGAAAGCGCAGTCTCTGAATT
ATCCTCATTAAAGCCAGAATTGACAGGAGGTTGAGGC
AGGTCAGACGATTGGCCTGCCGCCACCCTCAGAACCG
GGTCATAGCCCCCTTAAAACCTCAGAGCCGCCACCAGAAC
CCACCCTCAGAGCCACCATAGCGTTTGCCATCTTTTC
ATAATCAAAATCACCGGAGAATCAAGTTTGCCTTTAG
ATCACCAGTAGCACCAAAAAAATTTCATCGGCATTTTC
CGTCAGACTGTAGCGCGTTTACCATTAGCAAGGCCGG
AAACGTCACCAATGAAACGGTGAATTATCACCGTCAC
ATGGTTTACCAGCGCCAAAAAAAATTAGAGCCAGCAAA
CGACTTGAGCCATTTGGGAAGACAAAAGGGCGACATT
CAACCGATTGAGGGAGGGAGGTTTTGAAGCCTTA
AATCAAGATTAGTTGCTCAATAGAAAATTCAT
GAATAAGTTTATTTTGTCTATTTTGCACCCAGCTACA
TTCCAGAGCCTAATTTGCAGAAACGCAAAGACACCACG
TAAAGGTGGCAACATATACAGTTACAAAATAAACAGC
TGTTTAACGTCAAAAATGAAACGTAGAAAATACATACA
TTATTACGCAGTATGTTAAAAATAGCAGCCTTTACAG
GAGAATTAACTGAACACCCTGGCATGATTAAGACTCC
ACGGAATACCCAAAAGATGAACAAAGTCAGAGG
ACAAGAATTGAGTTAAAGGAAACGCAATAATA
AAGTTACCAGAAGGAAACCAATAATAAGAGCAAGAA

AACGCCAACATGTAATAAAAAAAGCAGATAGCCGAACA
CTTTTTAAGAAAAGTAAGGCAGAGGCATTTTCGAG
AAGTAATTCTGTCCAGACCTATCTTACCGAAGCC
ACAATGAAATAGCAATAGAGGGAAGCGCATTAGACGG
GTAATTGAGCGCTAATAATCAGAGAGATAACCC
AGAGAATAACATAAAAACGACGACAATAAACAAC
ATGTTCAGCTAATGCAACAAATAAGAAACGATTTTT
CATATTATTTATCCCAATTATCATTCCAAGAACG
GGTATTAAACCAAGTAACCAACGCTAACGAGCGTCT
ATTTTATCCTGAATCTTAGAACGCGAGGCGTTTTAGC
GCTTATCCGGTATTCTAACCGCACTCATCGAGAACAA
ACCGCGCCCAATAGCACCTTTTTAACCTCCGGCTT
AATCCAATCGCAAGACAACATCGTAGGAATCATT
GCAAGCCGTTTTTATTTTGCATGTAGAAACCAATCAA
TAATCGGCTGTCTTTCCTGAACGCGCCTGTTTATCAA
CCATCCTAATTTACGAAGAACGCGAGAAAACTTTT
ATTTAATGGTTTGAAATACAAGAAAAATAATATC
CAATAGATAAGTCCTGAAAAAGTACCGACAAAAGGTA
CCAGTAATAAGAGAATATCCGACCGTGTGATAAA
TAAGGCGTTAAATAAGAATCGCCATATTTAAC
TCAACAGTAGGGCTTAAAATAAACACCGGAATCATA
AATACCAAGTTACAAAAAAAAAAGTATAAAGCCAACGC
TTATACAAATTCTTACCGCGCAGAGGCGAATTATT
AACATCAAGAAAACAAAATTTAGTATCATATGCG
ATTACTAGAAAAAGCCTGATTTCATCTTCTGACCTAA
TCAAATATATTTTAGTTATTAATTACATTTAACA
ATTTCATTTGAATTACATATGTAAATGCTGATGCA
AGGTTGGGTTATATAACTCGATAGCTTAGATTAAGAC
GAATCCTTGAAAACATAGCTTTTTTAATGGAAACAGT
TTCTGTAAATCGTCGCATCATCATATTCCTGATTA
TTGGATTATACTTCTGAAGAGTGAATAACCTTGC
ACATAAATCAATATATGTAAAAGAAGATGATGAAACA
CATTTCAATTACCTGAGCTAATGGAAGGGTTAGA
ACCTACCATATCAAAATCGCCTGATTGCTTTG
ATCGGGAGAAACAATAATTATTTGCACGTAAAACAG
GCCGTCAATAGATAATAAAAAATAACAGTACCTTTTAC
GTCAGATGAATATACAACATTTGAGGATTTAGAAG
ATCCTTTGCCCGAACGTTGATTTTCAGGTTTAAC
AAATAAAGAAATTGCGTATCAATATAATCCTGATTGT
TCAGATGATGGCAATTCAATTAATTTTAAAAGTTTGA
GTAACATTATCATTTTGCGGTGCCGGTGCCCCCT
GCATCAGACGATCCAGATTCGACAACTCGTATTAA
TATTAGACTTTACAAACATGAGGAAGGTTATCTAAAA
ATGAAAAATCTAAAGCATCACAAACAACTAATAGATTAGA
TATCTTTAGGAGCACTAATTGCTGAACCTCAAATATC
AACAGTTGAAAGGAATCGCAGTGTCACTGCGCGCC
CCGTTTTCACGGTCATACGGTCAGTTGGCAAATC
AAACCCTCAATCAATATCGGTGAGGCGGTCAGTATTA
TAGCCCTAAAACATCGCCATTCACGCTGAGAGCCAGCAGCAA
ACACCGCCTGCAACAGTGAAAATACCGAACGAACCAC
CAGCAGAAGATAAAACAGAGAATACGTGGCACAGACA
CATTGGCAGATTCACCAAAAGTCTTTAATGCGCGAACTGA
ATATTTTTGAATGGCTATAGTCACACGACCAGTAATA
TCTGACCTGAAAGCGTGGGGGTTTCTGCCAGCACG
TGAGGATCCCCGGGTACCACAGAGATAGAACCCT
AAAGGGACATTCTGGCCAGCTCATGGAAATACCTACA

TTGCCTGAGTAGAAGAAAAAAATGAAATGGATTATTTA
TTTTGACGCTCAATCGTCACTCAAACTATCGGCCTTG
TTGCAACAGGAAAAACGAGCTCGAATTCGTAATCA
TCACAATTCCACACAACAATATTACCGCCAGCCA
CTGGTAATATCCAGAACAATCACGCAAATTAACCGTT
AAGGGATTTTAGACAGAAAAAATTAGTAATAACATCAC
GTAGCAATACTTCTTTGAGAACGGTACGCCAGAATCC
GTAAAAGAGTCTGTCCTACGAGCCGGAAGCATAAA
ACATTAATTGCGTTGCGCTCAGTGAGGCCACCGA
TGAGAAGTGTTTTTATAATAACGTGCTTTCCTCGTTA
GGTCACGCTGCGCGTAAAAAAAAACAGGAGGCCGATTA
GAATCAGAGCGGGAGCTAACCACCACACCCGCCGCGC
CTTTGACGAGCACGTATCACTGCCCGCTTTCCAGT
CCAACGCGCGGGGAGAGGGCGCGTACTATGGTTG
TTAATGCGCCGCTACAGGAAGGAAGGGAAGAAAGCGA
GAGGTGCCGTAAAGCAAAAAAACGCTGGCAAGTGTAGC
AAGGAGCGGGCGCTAGGGCTAAATCGGAACCCTAAAG
GGCGAACGTGGCGAGACGGTTTGCGTATTGGGCGC
AGCTGATTGCCCTTCACCCTTGACGGGGAAAGCC
GGAGCCCCCGATTTAGAGAAAAGAATAGCCCGAG
ATAGGGTTGAGTGTTGACAAGTTTTTTGGGGTC
CTACGTGAACCATCACATTCCAGTTTGGAACAAGAG
GCACTCCAGCCAGCTTTCGGACTCCAACGTCAAA
TCCACTATTAAAGAACGTATGGTGGTTCCGAAATCGG
CAAAATCCCTTATAAATCGCCTGGCCCTGAGAGAGTT
GCGAAAATCCTGTTTGCGGCACCGCTTCTGGTGCC
GCAACTGTTGGGAAGGGCTGGTTTGCCCCAGCAG
GCAGCAAGCGGTCCACGCAACGACGGCCAGTGCC
AAGCTTTCAGAGGTGGCACCAGTGAGACGGGCAAC
CAGGGTGGTTTTTCTTTTGGGATAGCTCTCACGG
AAAAAGAGACGCAGAAAGCTGCATTAATGAATCGG
CGGGAAACCTGTCGTGCCGTGATGAAGGGTAAAG
TTAAACGATGCTGATTCTAATGAGTGAGCTAACTC
GTGTAAAGCCTGGGGTGCTGCTGGTCTGGTCAGC
AGCAACCGCAAGAATGGTGTGAAATTGTTATCCGC
TGGTCATAGCTGTTTCCTGCGCGGTTGCGGTATG
AGCCGGGTCACTGTTGCCGTGAGCCTCCTCACAGT
CGTGCCTGTTCTTCGCGTGCGGCCAGAATGCGGCGGG
TGTGCACTCTGTGGTGCTGTTAACGGCATCAGATGCC
TGGTGTGTTCAGCAAATCCCCTGCGGCTGGTAATGGG
TAAAGGTTTCTTTGCTCGGGGGTCATTGCAGGCGCTT
TCGCACTCAATCCGCCGGCCAACGGCAGCACCGTCGG
TGGTGCCATCCCACGCAATAACGGAACGTGCCGGACT
TGTAGAACGTCAGCGTGGGCCGTTCCGGCAAACGCGG
TCCGTTTTTTCGTCTCGTAAAAATCCCGTAAAAAAAG
CCGCACAGGCGGCCTTTAACAGCGGATCAAACTTAAA
TTTCTGCTCATTTGCCGCCCGGAATTTGTGAGAGATA
GACTTTCTCCGTGGTGAAAGCCGCCACGGGAACGGAT
AACCTCACCGGAAACAATGGGTAACGCCAGGGTTTTC
CCAGTCACGACGTTGTAAGATCGGTGCGGGCCTCTTC

Supplementary table 6. Staple strand sequences for folding the ring flat sheet.

GGCGACATTCAACCGATTGAGGGAAGCAGTTGGGCGGTTG
ACCGACTTGAGCCATTTGGTTTACCAGCGCCAAAGACAAAAG
CAATAGAAAATTCATATGATGATTAAGACTCCTTATTA
TGTACATCGACATAAAAAAGTTTATTTTGTCACAAT
ATAAAAGAAACGCAAAGACACCACGGAATCGGCCAGAGCACATCCTCA
TGGTCAGCAGCAACCGCAAGAATGCCATAGAAAATACATACATAAAGGTGGCAACAT
CGCAGTATGTTAGCAAACGACGGCAGCACCGTCGGTGGTGCCAT
TAATAACGGAATACCCAAAAGAACTGGCAGAATTAGAGCCAGCAA
CCCACGCAACCAGCTTACGGCTGGTTACCAGAAGGAAACCGAGGAAACGCAA
AAGCAGATAGCCGAACAAAATGTCCAGCATCAGCGGGGTCATTG
AATCACCAGTAGCACCAAAGCCCTTTTTAAGAAAAGT
ACAATGAAATAGCAATAGCTATCTTACCGTTTTCGGTCATAGCCC
CAGGCGCTTTCGCACTCAATCCGTGAGTTAAGCCCAATAATAAGAGCAAGAA
AGAGATAACCCACAAGAATACGCGGTTGCGGTATGAGCCGGGTC
CCTTATTAGCGTTTGCAAAATTGAGCGCTAATATCAG
AACTGAACACCCTGAACAAAGTCAGAGGGCCACCACCAGAGCCGC
ACTGTTGCCCTGCGGCTGGTAATAACAGGGAAGCGCATTAGACGGGAGAATT
CAGAGAGAATAACATAAAAAAGGTTTCTTTGCTCGTCATAAAC
CGCCAGCATTGACAGGAAATGAAAATAGCAGCCTTTA
TAAGAAACGATTTTTTGTTTAACGTCAAATTTGATGATACAGGAG
ATCCCTTACACTGGTGTGTTCAGAAACAGCCATATTATTTATCCCAATCCAAA
TTTGCCAGTTACAAAATAACGTTAACGGCATCAGATGCCGGGT
TGTACTGGTAATAAGTAAGCGTCTTTCCAGAGCCTAA
TTTTATCCTGAATCTTACCAACGCTAACGGAAGGATTAGGATTAG
TACCTGCAGCCAGCGGTGCCGGTATTAGTTGCTATTTTGCACCCAGCTACAA
TTGAAGCCTTAAATCAAGCTGCATCAGACGATCCAGCGCAGT
CGGGGTTTTGCTCAGTAACCCGACTTGCGGGAGGTT
TCTAAGAACGCGAGGCGTTTTAGCGAACCCCCTCAGAGCCACCAC
GTCACTGCGCGCCTGTGCACTCTAAAATCAGATATAGAAGGCTTATCCGGTAT
CCGCGCCCAATAGCAAGCAGCTGCGGCCAGAATGCGGCGGGCC
CCTCATTTTCAGGGATAATTCATCGTAGGAATCATTA
CTCATCGAGAACAAGCAAGCCGTTTTTATCGTCTTTCCAGACGTT
GTTTTCACGGTCATACCGGGGGTACAAGAACGGGTATTAAACCAAGTACCGCA
TGTCTTTCCTTATCATTCCCAGCACGCGTGCCTGTTCTTCGC
AGTAAATGAATTTTCTAAAACCAATCAATAATCGGC
AATATCCCATCCTAATTTACGAGCATGTAAAAGGAGCCTTTAATT
GTCCGTGAGCCTCCTCACAGTTGAACAATAGATAAGTCCTGAACAAGAAAAAT
GAACGCGCCTGTTTATCAACCCCGGGTACCGAGCTCGAATTCG
GTATCGGTTTATCAGCAAAACATGTTCAGCTAATGCA
AGTAATTCTGTCCAGACGACGACAATAAAGCCGCTTTTGCGGGAT
TAATCATGGTCATAGCTGTTTCCAAGAGAATATAAAGTACCGACAAAAGGTAA
ATTTTCGAGCCAGTAATAGAAATTGTTATCCGCTCACAATTC
CGTCACCCTCAGCAGCAATGTAATTTAGGCAGAGGC
TTGAGAATCGCCATATTTAACAACGCCAACCTAAAACGAAAGAGG
CACACAACATACGAGCCGGAAGCATAAAGCCAACGCTCAACAGTAGGGCTTAA
TACAAATTCTTACCAGTAAGTGTAAAGCCTGGGGTGCCTAATG
CAAAAGAATACACTAAAATTTAGTATCATATGCGTTA
ACCGGAATCATAATTACTAGAAAAAGCCTAACGAGGCGCAGACGG
AGTGAGCTAACTCACATTAATTGGATAAATAAGGCGTTAAATAAGAATAAAC
TTGAAATACCGACCGTGTACGCTCACTGCCCGCTTTCCAGTCG
TCAATCATAAGGGAACAACTGACCTAAATTTAATGGT
TTTCAAATATATTTTAGTTAATTTCATCTGTAACAAAGCTGCTCA
GGAAACCTGTCGTGCCAGCTGCAAATCGCAAGACAAAGAACGCGAGAAAACTT
AATGCTGATGCAAATCCAAGAATCGGCCAACGCGCGGGGAGAG

TTCAGTGAATAAGGCTAAGGTTATATAACTATATGTA
GACTACCTTTTTAACCTCCGGCTTAGGTTGGACGTTGGGAAGAAA
GCGGTTTGCGTATTGGGCGCCAGAGTGAATTTATCAAAATCATAGGTCTGAGA
CGCTGAGAAGAGTCAATAATTTTTCTTTTCACCAGTGAGACGG
AATCTACGTTAATAAAAAGCGATAGCTTAGATTAAGA
TAATTTTCCCTTAGAATCCTTGAAAACATGCAACACTATCATAAC
GCAACAGCTGATTGCCCTTCACCACCTTGCTTCTGTAAATCGTCGCTATTAAT
ATATATGTGAGTGAATAAAGCCCTGAGAGAGTTGCAGCAAGCG
CCTCGTTTACCAGACGAAGGAAACAGTACATAAATCA
AACAATTTCATTTGAATTACCTTTTTTAAGAATCCCCCTCAAATG
GTCCACGCTGGTTTGCCCCAGCAAACATCAAGAAAACAAAATTAATTACATTT
AAGAAGATGATGAAACAAAAAATCCTGTTTGATGGTGGTTCCG
CTTTAAACAGTTCAGAAAATTTCAATTACCTGAGCAA
GTTACAAAATCGCGCAGAGGCGAATTATTTTAATTCGAGCTTCAA
AAATCGGCAAAATCCCTTATAAAACGGATTCGCCTGATTGCTTTGAATACCAA
CATCGGGAGAAACAATAAAAGAATAGCCCGAGATAGGGTTGAG
AGCGAACCAGACCGGAAAACAGTAACAGTACCTTTTA
AGATTTTCAGGTTTAACGTCAGATGAATATTTAAATATGCAACTA
TGTTGTTCCAGTTTGGAACAAGAACACGTAAAACAGAAATAAAGAAATTGCGT
CCATATCAAAATTATTTGACTATTAAAGAACGTGGACTCCAAC
AAGTACGGTGTCTGGAAAATGGAAGGGTTAGAACCTA
TCCTGATTGTTTGGATTATACTTCTGAATCGAGCTGAAAAGGTGG
GTCAAAGGGCGAAAAACCGTCTAATATCAGATGATGGCAATTCATCAATATAA
TATCATCATATTCCTGATAGCGATGGCCCACTACGTGAACCAT
CATCAATTCTACTAATAACCACCAGAAGGAGCGGAAT
GTAACATTATCATTTTGCGGAACAAAGAAAATACTTTTGCGGGAG
CACCCAAATCAAGTTTTTTGGGGACCCGAACGTTATTAATTTTAAAAGTTTGA
CTCGTATTAAATCCTTTGAGTGCCGTAAAGCACTAAATCGGAA
AAGCCTTTATTTCAACAATTTACAAACAATTCGACAA
AATACATTTGAGGATTTAGAAGTATTAGATATTCAACCGTTCTAG
CCCTAAAGGGAGCCCCCGATTTAACAACTAATAGATTAGAGCCGTCAATAGAT
TATCTTTAGGAGCACTAAATGACGGGGAAAGCCGGCGAACGTG
CTGATAAATTAATGCCAATGAGGAAGGTTATCTAAAA
TCAGTTGGCAAATCAACAGTTGAAAGGAACCGGTTGATAATCAGA
GCGAGAAAGGAAGGGAAGAAAGCACAAATATCAAACCCTCAATCAATATCTGG
CATCACCTTGCTGAACCTAGAGCGGGCGCTAGGGCGCTGGCAA
AAAGCCCCAAAAACAGAAGCAAATGAAAAATCTAAAG
CCTGCAACAGTGCCACGCTGAGAGCCAGCGCGTCTGGCCTTCCTG
GTGTAGCGGTCACGCTGCGCGTACAGAGGTGAGGCGGTCAGTATTAACACCG
CACCAGCAGAAGATAAAAACACACCCGCCGCGCTTAATGCGCC
TAGCCAGCTTTCATCAAATTAAAAATACCGAACGAAC
GCGCGAACTGATAGCCCTAAAACATCGCCAGTTTGAGGGGACGAC
GCTACAGGGCGCGTACTATGGTTAATATTTTTGAATGGCTATTAGTCTTTAAT
GAATACGTGGCACAGACAATGACGAGCACGTATAACGTGCTTT
GACAGTATCGGCCTCAAATTCTGACCTGAAAGCGTAA
GGGACATTCTGGCCAACAGAGATAGAACCCGCTATTACGCCAGCT
CCTCGTTAGAATCAGAGCGGGAGATTCACCAGTCACACGACCAGTAATAAAA
GATTATTTACATTGGCAGCAGGAGGCCGATTAAAGGGATTTT
GGCGAAAGGGGGATGTACGCTCAATCGTCTGAAATG
AAAACGCTCATGGAAATACCTACATTTTGAAACAATCGGCGAAAC
AGACAGGAACGGTACGCCAGAATACAATATTACCGCCAGCCATTGCAACAGGA
TGCTGGTAATATCCAGAAAGAGAAGTGTTTTTATAATCAGTGAGGC
GTACAGCGCCATGTTTAAGAACTCAAACTATCGGCCT
ATTAGTAATAACATCACTTGCCTGAGTAGAAAACGCGGTCCGTTTTTTCG
TAACGGAACGTGCCGGACCGCAAATTAACCGTTGTAGCAATACTTCTTTG
CACCGAGTAAAAGAGTCTGTCCATCAATTGTAGAACGTCAGCGTGGTGCTGGTC

TCTCGTCGCTGGCAGCCTAAAAATCCCGTAAAAAAAGCCGCAC
TGATTGCCGTTCCGGCCCAGTCCCGGAATTTGTGAGAGAT
GACGCAGAAACAGCGGAATAAAGTTAAACGATGC
AGGCGGCCTTTAGTGATGAAGGGAAACTTAAATTTC
TGCTCATTTGCCGAAAGGAAGGTAAATATTGA
CCAGTGCCAAGCTTTCAACTCTCACGGAAAAAGA
AGACTTTCTCCGTGGTGAAGGGAAGAGGTGGAGCCGCCACGG
GAACGGATAACCTCACCGGCTGCAAGGCGATTAAGTTGGGTA
ATTCGCCATTCAGGCTACGTTGTAAAACGACGG
ACGCCAGGGTTTTCCCAGTCACGGCGCAACTGTTGGGAAGGG
CGATCGGTGCGGGCCTCTGGAAGATCGCACTCCAGCCAGCTT
TAATGGGATAGGTCACAAACCAGGCAAAGCGCC
TCCGGCACCGCTTCTGGTGCCGGGTTGGTGTAGATGGGCGCA
TCGTAACCGTGCATCTGCACATTAAATGTGAGCGAGTAACAA
TTTTGTTAAATCAGCTAAACGGCGGATTGACCG
CCCGTCGGATTCTCCGTGGGAACCATTTTTTAACCAATAGGA
ACGCCATCAAAAATAATTGAAGATTGTATAAGCAAATATTTA
ACAAGAGAATCGATGAAAAAATTCGCATTAAAT
AATTGTAAACGTTAATATTTTGTACGGTAATCGTAAAACTAG
CATGTCAATCATATGTACGGAGAGGGTAGCTATTTTTGAGAG
AAAGATTCAAAAGGGTAGCCGAGTCTGGAGCAA
ATCTACAAAGGCTATCAGGTCATGAGAAAGGCCGGAGACAGT
CAAATCACCATCAATATGGCAAGGATAAAAATTTTTAGAACC
AAAGCCTCAGAGCATAATGAGTAATGTGTAGGT
CTCATATATTTTAAATGCAATGCAAGCTAAATCGGTTGTACC
AAAAACATTATGACCCTGAGTAGTAGCATTAACATCCAATAA
GATACATTTCGCAAATAAGCAAAATTAAGCAAT
ATCATACAGGCAAGGCAAAGAATGGTCAATAACCTGTTTAGC
TATATTTTCATTTGGGGCAGTTTCATTCCATATAACAGTTGA
TTTGCGGATGGCTTAGATTTAGTTTGACCATTA
TTCCCAATTCTGCGAACGAGTAGAGCTTAATTGCTGAATATA
ATGCTGTAGCTCAACATGAGCAAACTCCAACAGGTCAGGATT
CGGATTGCATCAAAAAATTGATAAGAGGTCATT
AGAGAGTACCTTTAATTGCTCCTGATTAAGAGGAAGCCCGAA
AGACTTCAAATATCGCGTAAACGAGAATGACCATAAATCAAA
AAATGTTTAGACTGGAAATAGTCAGAAGCAAAG
AATCAGGTCTTTACCCTGACTATTAGCGTCCAATACTGCGGA
ATCGTCATAAATATTCATACGATAAAAACCAAAATAGCGAGA
CATTCAACTAATGCAGAAGAGGGGGTAATAGTA
GGCTTTTGCAAAAGAAGTTTTGCATACATAACGCCAAAAGGA
ATTACGAGGCATAGTAAGACGAACTAACGGAACAACATTATT
AATCATTGTGAATTACAAGATTTAGGAATACCA
ACAGGTAGAAAGATTCATCAGTTCTTATGCGATTTTAAGAAC
TGGCTCATTATACCAGTCTGCCCTGACGAGAAACACCAGAAC
ACCTTCATCAAGAGTAAGTTTAATTTCAACTTT
GAGTAGTAAATTGGGCTTGAGATATCTTGACAAGAACCGGAT
ATTCATTACCCAAATCAACGAACTGACCAACTTTGAAAGAGG
CATCGCCTGATAAATTAGCGCATAGGCTGGCTG
ACAGATGAACGGTGTACAGACCAAGTGTCGAAATCCGCGACCT
GCTCCATGTTACTTAGCCAACACTCATCTTTGACCCCCAGCGA
TGAGGAAGTTTCCATTACAACGGAGATTTGTAT
TTATACCAAGCGCGAAACAAAGTAAACGGGTAAAATACGTAA
TGCCACTACGAAGGCACCAAAAGACAGCATCGGAACGAGGGTA
ATCGCCCACGCATAACAACTAAAGACTTTTTCA
GCAACGGCTACAGAGGCTTTGAGCGATATATTCGGTCGCTGA
GGCTTGCAGGGAGTTAAAATGCTTTCGAGGTGAATTTCTTAAA

AGGAATTGCGAATAATAGACAATGACAACAACC
CAGCTTGATACCGATAGTTGCGCAATTTTTTCACGTTGAAAA
TCTCCAAAAAAAAAGGCTCATATGGGATTTTGCTAAACAACTTT
CTGTAGCATTCCACAGAAGAAAGGAACAACTAA
CAACAGTTTCAGCGGAGTGAGAAACAGCCCTCATAGTTAGCG
TAACGATCTAAAGTTTTGAGCAAGCCCAATAGGAACCCATGTA
TACTCAGGAGGTTTAGAGTACAAACTACAACGC
CCGTAACACTGAGTTTCGTCACCTACCGCCACCCTCAGAACC
GCCACCCTCAGAACCGCCACCAGGCGGATAAGTGCCGTCGAG
CGGAACCTATTATTCTAAATAGGTGTATCACCG
AGGGTTGATATAAGTATAGCCCGGAAACATGAAAGTATTAAG
AGGCTGAGACTCCTCAAGTTTAACGGGGTCAGTGCCTTGAGT
GAATGGAAAGCGCAGTATGCCCCCTGCCTATTT
AACAGTGCCCGTATAAACAGTTACTCTGAATTTACCGTTCCA
GTAAGCGTCATACATGGCAGGTTGAGGCAGGTCAGACGATTG
CCACCCTCAGAACCGCAATCCTCATTAAAGCCA
GCCTTGATATTCACAAACAAATACACCCTCAGAGCCACCACC
CTCAGAGCCGCCACCAGACATCTTTTCATAATCAAAATCACC
GCGACAGAATCAAGTTAGCCTCCCTCAGAGCCG
GGAACCAGAGCCACCACCGGAACTGCCTTTAGCGTCAGACTG
TAGCGCGTTTTCATCGGCATTACCATTAGCAAGGCCGGAAAC
CGGAAATTATTCATTAAAGCACCGTAATCAGTA
GTCACCAATGAAACCATCGATAGAAGGTGAATTATCACCGTC

Supplementary table 7. Staple strand sequences for folding the three-hole disc flat sheet.

AACATTATGACCCTGTAATACTTAGGCAAGGCAAAGAATTAGCAAAA
ATTTTAAATGCAATGCCTGAGTATAAAGCTAAATCGGTTGTACCAAA
TTAAGCAATAAAGCCTCAGAGCAAAAAGATCTACAAAGGCTATCA
ATTAACATCCAATAAATCATAATTGCGGGAGAAGCCTT
CATATAACAGTTGATTCCCAAAAAAATTCTACTAATAGTAGTAGC
GCGCGAGCTGAAAAGGTGGCATCTCTGCGAACGAGT
TATTTCAACGCAAGGAATGTTTAGCTATATTTTCATTTGGG
CAAATGGTCAATAACCACAGCGATTATACC
CCTGATAAATTGTGTCGAAATCCCATTAGATACATTTCG
AGATTTAGTTTGAGAATATAATGCTGTAGCTCAACAT
TCCAACAGGTCAGGATAAAACGGTGTCTGGAAGTTTCATTC
GTTTTAAATATGCAACTAAAGTATAGAGAGTACCTTTAATTG
TTAGAGCTTAATTGCTCGACCTGCTCCATGTTACT
CTGACCAACTTTGAAAGAGGACACATTTTTGCGGATGGC
CTCCTTTTGATAAGAGGTCCGAAAGACTTCAAATATCGCGTT
TGACCATAAATCAAAAAAAACAGACCGGAAGCAAAC
TTAATTCGAGCTTCAAAGCGAACATCAGGTCTTTACCCTGAC
AAGATTAAGAGGAAGCAAAATGAACGGTGTACAGACCAGGCGC
ATAGTAAGAGCAACACTATCAAGCGGATTGCATCAAA
TATTATAGTCAGAAGCAAGGAATCGTCATAAATATTCATTGA
CTAACGAGCGTCTAAAAAGTTCAGAAAACGAGAA
ATCCCCCTCAAATGCTTTAAACAAAGAGGGGGTAATAGTAAAATGTTT
AGACTGGATAGCGTCCAATACTGTAACCCTCGTTTA
TTTTGCAAAAGAAGTTTTGCCTTCCAGAGCCTAA
TTATCCCAATCCAAATAAAAAACCAAAATAGCGAGAGGC
CCAGACGACGATAAATTTAGGAATACCACATTC
CACCAGAACGAGTAGTAAAACGCCAAAAGGAATTACGAGGC
AACTAATGCAGATACATAACGTTAATAAAACG
AGATTCATCAGTTGAGAAAACGATTTTT
CAAAGTTACCAGAAGGATTATTACAGGTAGAA
AACTAACGGAACAAGGCAACATATAAAAGA
GTTGGGAAGAAAAATCTAAATTGGGCTTGAGATGGTTTA
AACGCAAAGACACCACATCATTATACCAGTCAGGAC
GATTTTAAGAACTGGCACGGAAATTATTCATT
AGTAACAGTGCCCGTAGTGAATTACCTTATGC
ATTTCAACTTTAATCATTAGGCTTGCCCTGACGAGAAA
GCTGCTCATTCAGTGAATAAACAGTTAATGCCCCCT
ATTAAGAGGCTGAGACTCAAATCAACGTAACAAA
CCGGATATTCATTACCTTTCCAGACGTTAGTAAAT
TCAGCGGAGTGAGAATAGAAAGGGTAATCTTGACAAGAA
ATAGGCTGGCTGACCTTCATCAAAACGGTCAATCATAAGGGAACCGAA
TAGCCGGAACGAGGCGCAAACAACTAAAGGAATT
GCGAATAATAATTTTTGTACAACGGAGATTTGTATCATCG
AAGCGCGAAACAAAAGCCACTACGAAGG
TAAAACACTCATCTTTGACCCATAAAAATTTTTAGAACCCTCATAT
AAAGGGTGAGAAAGGCCGGAAAGAGGCAAAAGAATACAC
CACCAACCTAAAAAAAGCTACAGAGGCTT
TTAAACGGGTAAAATACGTAAACGTTGAAAATCT
AATTGTATCGGTTTTTTTCATGAGGAAGTTTCCA
TGAGGACTAAAGAAAGTTAAAGGCCGCT
CATCGGAACGAGGGTAGCAACAAGACAGTCAAATCACCATCAA
ATTCGCGTCTGGCCTTCCTGTAACCCTCAGCAGCGAAAGACAG
TTTGCGGGATCGTATAACCGTGCATCTGCC
TTCGGTCGCTGAGGCTTGCAGGGATCAGCTTGCTTTCGAGGTG

AGTTTGAGGGGACGACACATCGCCCACGCATAACCGATATA
CGACAATGACAACAACTCGGTGCGGGCCTCTTCGC
AAGTTGGGTAACGCCAGGGTTTTATACCGATAGTTGCGC
AATTTCTTAAACAGCTTGAATAGCAAGCCCAATAGGAACCC
ATGTACCGTAACACTGAGTTTAAAAGGAGCCTTT
CCAAAAAAAAGGCTTTGCTAAACAACTTTCAACAGTT
GAATTTTCTGTATGGGATGTCACCAGTACAAACTACA
AACGATCTAAAGTTTTGTCGTATCAAGAGAAGGATTAGGATTA
GCGGGGTTTTGCTCAGTACCAAAGACAGCCCTCATAGTTAGCGT
ACGCCTGTAGCATTCCACACCGCCACCCTCAGAGCCA
CCACCCTCATTTTCAGGGAAAACCAGTCACGACGTTGTAAAACGAC
ACCGCCACCCTCAAGGCGGATAAGTGCCGTCGA
ATAAATCCTCATTAAAAAAACGCCACCCTCAGA
CGTACTCAGGAGGTTTAGTACCCAGAATGGAAAGCGCAGT
ATGGCTTTTGATGAGCCCGGAATAGGTGTATCAC
GAGGGTTGATATAAGTATTATTCTGAAACATGAAAGT
GCCTATTTCGGAACCTATACAGGAGTGTACT
AAAGGTGAATTATCACCGGGGTCAGTGCCTTG
GGTAATAAGTTTTCGTAATCAGTAGCGAC
AGAATCAAGTTTGCCTAGTAAGCGTCATAC
CTCTGAATTTACCGTTCCATTGACAGGAGGTTGAGGC
TCAGAACCGCCACAAAATGATATTCACAAACAA
AGGTCAGACGATTGGCCTACCTCAGAGCCACC
CAGAGCCGCCGCCAGCATAGCGTCAGACTG
CCCCCTTATTAGCGTTTGCCACCAGAACCACCAC
ACCCTCAGAGCCGAGAGCCGCCACCC
CACCGGAACCGCCCCATCTTTTCATA
CAATTTCATTTGAATTAGAACCAGAGCCAC
ATCAAAATCACCGTTAGATTAAGACGCTG
AGAAGAGTCAATAGTGTCGGCATTTTCGGTCATAG
TAGCGCGTTTTCAAACACCAATGAAACC
ATCGATAGCAGCAATCACCGACTTGAGCCATTT
CATTAGCAAGGCCGGAAACGTAATTTATCAAAATCATAGG
AGGTTGGGTTATAAATCACCAGTAGCACCATTAC
GGGAATTAGAGCCAGCAAGATTGAGGGAGGG
AAGGTAAATATTGAGAATAAGTTTATTTTGTCA
ACAAAAGGGCGACATTCAACCAAAAAACTATATGTAAA
CCAAGTACCGCACTCATCAATATGGTTTACCAGCGCCAAAG
CAATCAATAGAAAATTCAAAACGTAGAAAAT
ACATACATAAAGGAAACCGAGGAAACGCAATA
CTTATTACGCAGTATGTTAGCAAGAACAAGCAAGCCGTTTT
AATAGCAAGCAAAGAACTGGCATGATTAAGACTC
ATAACGGAATACCCAAAATCTTACCGAAGCC
TGTTTAACGTATAAGCAGATAGCCGAA
CTTTTTAAGAAAAAGCTAATATCAGAGAGATAA
ACAATGAAATAGCAATAGCTATCAGATATAGAAGGCTTATCCGGT
CGACTTGCGGAGCCCAATAATAAGAGCAAGAA
CCCACAAGAATTGAGTTATTTTGAAGCCTTA
AGTCAGAGGGTAATTGAGAAAAATGAAAATAGCAGCC
AATCAAGATTAGTAAAACTGAACACCCTGAACAA
ATTAGACGGGAGAATTTGCTATTTTGCACCCA
GCTACAATTTTATCCTAAAAACAGGGAAGCGC
TTTACAGAGAGAATAACAAAATAAACAGCCATATTAT
TTTGCCAGTTACAAATCTTACCAACG
GAGAATATAAAGTACCAAAAAGCGAACCTCC
ATTCTAAGAACGCGAGGCGTTTTGACAAAAGGTAAAGTAATTCTGTCCAG

ACGACGACAATAAACAACATGTTCAGCATTACCGCGCCC
TATTTTCATCGTAGGAATATCCAAGAACGGGTATTAAA
TGTCTTTCCTTATACTAATGCAGAACGCGCCTG
TGACCTAAATTTAATGGTTTGAAAAATCAATAATCGGC
CCTAATTTACGAGCATGTAGAAACCAACGCTCAACAGTAGGGCTT
GTAATTTAGGCAGAGGTCCTGAACAAGAAAAATAATATCCCAT
TTTATCAACAATAGATAATTCGAGCCAGTAATAA
GATAGGGTTGAGTGTTGTTCCAAATTAACAACGCCAACAT
AATTGAGAATCGCCATATAGTTTGGAACAAGAGTCCACTATTAAA
CTTACCAGTATAAAGCCAATACCGACCGTGTGATAAATAAGGC
GAACGTGGACTCCAACGTCAAAGGGCCATATGCGTTATACAAATT
AAAGCCTGTTTAGTATCAGGAGGCCGATTAAAGGGATTTT
TCAGTGAGGCCACCGAGTATCATAATTACTAGAA
GTTAAATAAGAATAAACACCGGAATATATTTTAGTTAATTTCATCTTC
ACGCGAGAAAACTTTTAAGAGTCTGTCCATCACGCAA
GCTTCTGTAAATCGTCAAATCGCAAGACAAAGA
TGCTGATGCAAATATAACCTCCGGCTT
TCTGAGAGACTACCTTTTGCTATTAATTAATTTTCCCTTAGA
ATCCTTGAAAACATAGCGATAGCACCTTTTTTTAATGGAAACA
ATTAACCGTTGTAGCAATACTAGTGAGTGAATAACCTT
GTACATAAATCAATATATAATTACCTGAGCAAAAGAAGATGA
TATACTTCTGAATAATGGAAGGGAAAATTAATTACATTTAA
TGAAACAAACATCAAGAAAACAACAATAACGGATTCGCCTGA
GCGAATTATTCATTTCAACTTTGATTAGTAA
GGCCTTGCTGGTAATATCCAGAAACAAAATCGCGCAGAG
TTGCTTTGAATACCAAGTAGATTCACCAGTCACACGACCA
CTTTTACATCGGGAGAAATAGAACCTACCATATCAAAATTAT
GTAATAAAAGGGACATTCTGGAGAATATACAGTAACAGTAC
CAGGTTTAACGTCAGATCGCCATTAAAAATACCGAACGAA
ACACCGCCTGCAACAGTGAAATTGCGTAGATTTT
TTGCACGTAAAACAGAAATAAAGAACAATATAATCCTGATTGTTTGGAT
TATCAGATGATGGCAATTAACCACGCTGAGAGCCAGCAGCAAAT
CCCTCAATCAATATCTGGAATTATCATCATATTCCTGAT
ACCAGAAGGAGCGTCAGTTGGCAAATCAACAGTTGAA
TAATAGATTAGAGCCGTCAATAGAGAACAAAGAAACC
CATTATCATTAATAATACATTTGAGGATTTAGAAG
GCGCCATGTTTACAAAAATGCCAACGGCAGCACCGTCGGAAAAAAGTTTGAGTAA
GCCCGAACGTTATTAATTTTAAGCCCTGCGGCTGGTAATGG
ACACTGGTGTGTTCAGAACAACTCGTATTAAATCCTTT
TATTAGACTTTACAAACAATTCGAAATCGTTAACGG
CATCAGATGCCGGAATATCTTTAGGAGCACTAACAAC
AGGAATTGAGGAAGGTTATCTAAATTACCTGCAGCCAGCGGTG
CCGGTGCCCCCTGCATCAACTGAACCTCAAATATCAAA
GAAAAATCTAAAGCATCACCTTGACGATCCAGCGCAGTGTCA
CTGCGCGCCTGTGCACTCAGGTGAGGCGGTCAGTATTA
CCACCAGCAGAAGATAAAACAGAAGGTGCTGCGGCCAGAATGC
TAGCCCTAAAACAAAACAGAGATAGAACCCTTC
GGCGGGCCGTTTTCACGGAATGCGCGAACTGA
TTGAATGGCTATTAGTCTTTATACCGGGGGTTTCTGCCAGCACGC
GCCGGAAGCATAAAGTATACGTGGCACAGACAATATTT
TGACCTGAAAGCGTAAGAATCTGAAATGGATT
ATTTACATTGGCAAACAATATTACCGCC
CTACATTTTGACGCTCAATCGAGTAAAGCCTGGGGTGCCTAATGAG
TCCAGTCGGGAAACCTGTGAAAAACGCTCATGGAAATAC
AGCCATTGCAACAAGCGCTTAATGCGCCGC
TACAGGGCGCGTACTAACTGAGTAGAAGAACTCAAACTATC

TAACATCACTTGCACTGAGAAGTGTTTTTATAA
AGACAGGAACGGTACGCCAGAATGGTTGCTTTGACG
TCAGAGCGGGAGCTAAAGAAAAACCGTCTA
CAAGTTTTTTGGGGTCGAGGTGCGCTTTCCTCGTTAGAA
AGCACGTATAACGCGCTGGCAAGTGTAGCGGTCACGC
TGCGCGTAACCACCACACCCGCCGTGCCAGCTGCATTAATGAAT
AGCGAAAGGAGCGGGCGCTAGGGCGTAAAGCACTAA
CGGCCAACGCGCGGGGAGAGGCGTGGCGAGAAAGGAAGGGAAGAA
TTGACGGGGAAAGCCGGCGAAAGGCCCTGAGAGAGTTGCAGCA
AGCGGTCCACGCTGGTTTGCCAAGGGAGCCCCCGATTTAGAGC
ATCGGAACCCTAACAGGCGAAAATCCTGTTTGATGGT
GGTTCCGAAATCGGCAAAATCCCCACTACGTGAACCATCACCCAAAT
TCAGGGCGATGGCAATAAATCAAAAGAATAGCCCGA
AGCTGATTGCCCTTCACCCGGTTTGCGTATTGGGCGC
GGGTACCGAGCTCGAATTCGTAAAAACACCAGTGAGACGGGCAAC
CAGGGTGGTTTTTCTTTTTTGCGCTCACTGCCCGCTT
TGAGCTAACTCACATTAATTGCGTCATGGTCATAGCTGTTTCCTGTG
GTGCCTGTTCTTCGCGTCCGTGAATCCACACAACATACGA
TGAAATTGTTATCCGCTCACAATGCCTCCTCACAGTTGAGGATCCCC
GCGCTTTCGCACTCAAGTCATAAACATCCCTT
GTAAAGGTTTCTTTGCTCCGCCGGGCGCGGTTGCGGT
ATGAGCCGGGTCACTGTTATGGTGCCATCCCACGCAACCAGCT
GTGCCGGACTAAAAGCGGGGTCATTGCAG
TACGGCTGGAGGTGTCCAGCATCGTAGAACGTCAGCGTGGTGCTGGT
CTGGTCAGCAGCAACCGCAAGAAACAGTCCCGGAATTTGTGAGAG
ATAGACTTTCTCCGTGGTGAAACATAACGGAAC
CCTCCGGCCAGAGCACATAGGGATAGCTCTCACGGAAAAAGAG
CGCCAGCAGTTGGGCGGTTTCGTCTCGTCGCTGGCAG
GCAAACGCGGTCCGTTAATGTGTACATCGACATAAAAAAATC
GCTTCTGGTGCCGGAAACCAGAAAGCTGATTGCCGTTCCG
GGTAAAGTTAAACGATGCAAAGCGCCATTCGCCATTCAGG
TATTACGCCAGCTGGCGAGCCTTTAGTGATGAAG
CCGTAAAAAAAGCCGCACAGGCGAAGAGCCGCCACGGGAACGGA
TAACCTCACCGGAAACAAATAAATTTCTGCTCATTTGC
ACGCAGAAACAGCGGATCAAACTGGCGAAACGTACA
GGCCAGTGCCAAGCTTTCAGAGGAAGGGGGATGTGCTGCAAGGCGATT
CTGCGCAACTGTTGGGAAGGGCGACAGTATCGGCCT
ATTCTCCGTGGGAACAAACGGAAATCCAGCCAGCTTTCCGGCACC
CAGGAAGATCGCAGGATTGACCGTAATGGGATAGGTC
ACGTTGGTGTAGATGGGCGCATCAGCCAGCTTTCAT
TAAATTGTAAACGTTAATATTTTAAAAGAGCGAGTAACAACCCGTCGG
CAACATTAAATGTTTAAAATTCGCATTAAATTTTTGT
TATGATATTCAACCGTTCTAGATAGGAACGCCATCAAAAATA
TAAATCAGCTCATTTTTTAACCAAGGAAGATTGTATAAGCAAATATT
GGTCATTGCCGCCCCAAATGATAAATTAATGCCGGAG
AGGGTAGCTATTTTTGAGATGTGTAGGTAAAGATTCA

Supplementary table 8. Staple strand sequences for folding the hand flat sheet.

GGACGACGACAGTATCGGCCTCAGGAAGAGACAATGACAACAACCATCGC
TGCGCAACTGTTGGGAAGCATCGTAACCGTGCATCTGCCAGTTTGAGG
GGTCACGTTGGTGTAGATGGGCGTCCTGTAGCCAGCTTTCAT
CCACGCATAACCGATATATTCACGGCGGATTGACCGTAATGGGATA
TTCTCCGTGGGAACAAAGGCACCAACCTAAAACGAAAG
CAAAAACATTATGACCCTGTAATACTGTAACAACCCGTCGGA
CAACATTAAATGTGAGCGAGAGACAGTCAAATCACCATCA
ATAATTCGCGTCTGGCCTCGCATTAAATTTTTGTTAA
ATATGATATTCAACCGTTCTAAATAGGAACGCCATCAAAA
ATCAGCTCATTTTTTAACCGTAAAACTAGCATGTCAATCATA
ATTTAAATTGTAAACGTTAATATTTTGTTAAAATGCGATCGGTGCGGGCCTCT
AACGCCAGGGTTTTCCCAGTCACGACGTTGTAAAACGAAAGCCCCAAAAACAGGAAGATTGTATAAGCAAAT
TGTACCCCGGTTGATAATCAGAAGGCCAGTGCCAAGCTTGGGCACGA
CGATGAACGGTAAACTGATAAATTAATGCCGGA
ATATAGGGGCCTTGAATCGGCTGCAAACAAGAGAAT
GTCATTGCCTGAGAGTCTGGAAATTTCACATAAATCATTTC
TAAATATGCAACTAAAGTACGGAGATCTACAAAGGCTATCAG
GAGGGTAGCTATTTTTGAATGTGTAGGTAAAGATTCA
AAAGGGTGAGAAAGGCCGTTTGCGGGAGAAGCCTTTA
TTTAAATGCAATGCCTGAGTAAGTGTCTGGAAGTTTCATTC
AGTAGATTTAGTTATTTTTAGAACCCTCATATAT
TTTCAACGCAAGGATAAACAAGGCAAAGAATTAGCAA
AGGCAAAAGAATACACTAAAAACAGAGCATAAAGCTAAATCGGTTGTAC
AATTAAGCAATAAAGCCTATAAGGGAACCGAACTG
TAGCATTAACATCCAATAAATCATACAGGGACCATTAGATACATTTCG
ACCAACTTTGAAAGAGAAAGGTGGCATCAATTCTACTAATAGTAG
TTGGGGCGCGAGCTGAAAATAAGGCTTGCCCTG
AAATAGCGAGAGGCTTTTGCAAAAGATTAGCTATATTTTCAT
CAAATGGTCAATAACCTGATCAAAAATCAGGTCTTTACCC
TGACTATTATAGTCAGAAGCAAAATTCTGCGAACG
CATATAACAGTTGATTCCTGCTCCTTTTGATAAGAGGTCATTTTTGC
TCCGAACTCTGACCTCCTAATGCTGTAGCTCAACATGTTT
GGATGGCTTAGAGCTTAATTGCTGAATATAGGTGTAATGAGTAAACAGG
CAGGATTAGAGAGTACCTTTAATAAAGCGGATTGCATC
GCTTAAGCTACGTGGTGCGACCGGAAGCAAACTCCAACAGGT
TTTTAATTCGAGCTTCAAAGCGAACCAATTACCTCGATAAAGACGGA
GATTCGCCTGATTGCTTTGAAGAAGCCCGAAAGACTTCAAATATCGCG
AAAAAGATTAAGAAATGCTTTAAACAGTTCAGA
AAACGAGAATGACCATAAAGTTTTGCCAGAGGGGGTA
CATAAATATTCATTGAATCCCCCTCAACCAAGTTACAAAATCGCG
AAGATGATGAAACAAACAGGATAGCGTCCAATACTGCGGAATCGT
ATAGTAAAATGTTTAGACAATAGTAAGAGCAA
ACGAGAAACACCAGAATCGTTTACCAGACGACGATAAAAACCA
CACTATCATAACCAAACGTTAATAAAACGAACTAACGGAA
ATGCAGATACATAACGCCAAAAGGAATTACGAGGAACAAGAAAACAAAATTAATTACATT
AAATCAATATATGTGAGTAAATCAGTTGAGATTTAGGAATACCACATTCAACTA
CAACATTATTACAGGTAGAAAGATCGGCATTTTCGGTCATAGCCCCCTTA
CAGGACGTTGGGAAGAAAAATCTCGAGTAGTAAATTGGGCTT
TTAGCGTTTGCCATCTTTTCATAATCATAAGAACTGGCTCATTATACCAGT
TTACCTTATGCGATTTAGAACCGCCACCCTCA
GAGCCACCACCCTCAGACTTTAATCATTGTGAA
GAGATGGTTTAATTTCAAATTACCCAAATCAACGTAA
CAAAGCTGCTCATTCAGTAACAGATGAACGGTGTACAGACCAG
CAAGAACCGGATATTCACCGCCACCAGAACCAC

CACCAGAGCCGCCGCCATCAAGAGTAATCTTGA
GCGCATAGGCTGGCTGACCTTCAAGACCTGCTCCATGTTACTTAGCCG
GAACGAGGCGCAGACGGTCAATCACTCATCTTTGACCCCCAGCGATTATACC
AATTGTGTCGAAATCCAAAGCATTGACAGGA
AAACAAATAAATCCTCATTAAAGGTATCATCGCCTGATA
AAGCGCGAAACAAAGTACAACGGAGATTTTTGAGGACTAAAGACTTTTTCATGAGGAAGTTTC
CATTAAACGGGTAAAATACGTAATGCCACTACGAGTCGCTGAGGCTTGCAGGGAGTTAAAGGCCGCTT
CAACGGCTACAGAGGCACCAGAATGGAAAGCGCAGTCTCTGAAT
CCAAAAAAAAGGCTCCAAAAGGAGCCTTTATCGGAACGAGGGTAG
TTGCGGGATCGTCACCCTCAGCAGCGAAAGACAGTATCGGTTTATCAGCTTGCTTTCGAGGTGAAT
TTCTTAAACAGCTTGATACCGATAGTTGCGCAAAAACGCACTCCAGCCAGCTTTCCGGCACCG
TTACCGTTCCAGTAAGCGTCATACATGAATAATAATTTTTTCACGTTGAAAATCT
AAGGAACAACTAAAGGAAGGCTTTTGATGATACAGGAGTGTACTGGT
GCCTATTTCGGAACCTATTATTCTGAAACATGAATCAGCGGAGTGAGAATAGA
TTGCTAAACAACTTTCAACAGAGTATTAAGAGGCTGAGACTCCTCAAG
CACCCTCATTTTCAGGGATAGATGAATTTTCTGTATGGGATT
TCTAAAGTTTTGTCGTCTTTCCAGACGTTAGTAAAAAAGCCCAATAGGAACCCATGTACCGTAACACTGA
AGAAGGATTAGGATTAGCGGGGTTTTATTCCACAGACAGCCCTCATAGTTAGCGTAACGA
GTTTCGTCACCAGTACAAACTACAACGCCTGTAGAGGTTTAGTACCGCCACCC
TCAGAACCGCCACCCTCAAACCGCCACCCTCAGAGCCAC
TAGGTGTATCACCGTACTAGCTCAGTACCAGGCGGATA
GGTTGAGGCAGGTAAAATATAAGTATAGCCCGGAA
AGTGCCGTCGAGAGGGTTGTAACAGTGCCCGTATAAACAGTTAATGCCCCCT
AATAAGTTTTAACGGGGTCAGTGCCTTGAACAGACGATTGGCCTTGATATTCAC
TCAGAGCCGCCACAAAATCACCGGAA
GAAGGTAAATATTGACGGAAAAAAAGGAACCGCCTCCC
CCAGAGCCACCACGTAATCAGTAGCGACAGAATCAAGTTTGC
CTTTAGCGTCAGACTGTAGCGCGTTTTCACCTAATTTGCCAGTTA
ATGAAACCATCGATAGCAGCACCAAATTATTCATTAAAGGTG
CAAAATAAACAGCCATTTAGCAAGGCCGGAAACGTCACCA
CAAAATCACCAGTAGCACCATTACCAATATTTATCCCAATCCAAATAA
ACAGAGAGAATAACATAAAAACACTTGAGCCATTTGGGAATTAGAGCCAG
AATTATCACCGTCACCGATTCAACCGATTGAGGGAGG
GCCAAAGACAAAAGGGCGACAGGGAAGCGCATTAGACGGGAG
AATTAACTGAACACCCTGAACAAATTCATATGGTTTACCAGC
TTTATTTTGTCACAATCAAATACATACATAAAGGTGGC
CCGAACAAAGTTACCAGAAGGAAAAAGACACCACGGAATAAG
AACATATAAAAGAAACGCAAACCGAGGAAACGCAATAATAAC
AGTATGTTAGCAAACGTAGAAAAAAGTCAGAGGGTAATTGAGCGCT
TAAGAGCAAGAAACAATGAAAGATTAAGACTCCTTATTACGC
GGAATACCCAAAAGAACTGGCATGCAATAGCTATCT
TACCGAAGCCCTTTTAAGAAAAGTAAGCAGATAG
GAAACGATTTTTTGTTTAACGAAGAATTGAGTTAAGCCCAATAA
AATATCAGAGAGATAACCCACAATCAAAAATGAAAATAGCAGCCTTT
GAGCGTCTTTCCAGAGAAATAACCTTGCTTCTG
TAAATCGTCGCTATTATCTTACCAACGCTAAC
TGCACCCAGCTACAATTTTATAATGCTGATGCAAATCCAATCG
CAAGACAAAGAACGCGAGAAAAAATCAAGATTAGTTGCTATTT
CGACTTGCGGGAGGTTTTGAAATATACAAATTCTTACCAGTAT
AAAGCCAACGCTCAACAGTAGAGAGGCGTTTTAGCGAACCTCC
GAAGGCTTATCCGGTATTCTAAAACAATAGATAAGTCCTGAAC
AAGAAAAATAATATCCCATCCATAGCAAGCAAATCAGATATA
TAGGAATCATTACCGCGCCCATAATTTACGAGCATGTAGAAACCAATCAA
CCGCACTCATCGAGAACAAGCAAGCCGTTTTTATTTTCATCG
AAGGTAAAGTAATTCTGTCCAGACGAGAACGGGTATTAAACCAAGTA
TAATCGGCTGTCTTTCCTTATCATTCCAACGACAATAAACAACATGTTCAGCT

AATGCAGAACGCGCCTGTTTATCGCTTAATTGAGAATCGCCATATTTAACAACGCCA
AGGCGTTAAATAAGAATAAACAAATAATAAGAGAATATAAAGTACCGACAA
ACATGTAATTTAGGCAGAGGCATTTTCGAGCCAGAACCGGAATCATAATTACTAGAAAA
AGCCTGTTTAGTATCATATGCGTAACTTTTTCAAATATATTTTAGTTAATTTC
CAAAATCATAGGTCTGAGAGAAAAAAAATACCGACCGTGTGATAAATA
ATCTTCTGACCTAAATTTAATGGTTTGAAATACCTTTTTAACCTCCGGCTTAGG
TTGGGTTATATAACTATATGTAAAATTAATTTTCCCTTAGAATCCTTGAAAAC
ATTGAGGAAGGTTATCTAAAGAGTCAATAGTGAATTTAT
ATAGCGATAGCTTAGATTAAGACGCTGAGATTTAATGGAAACAGTACAT
TAACAATTTCATTTGAATTACCTACATTATCATTTTGCGGAACAAAGAAACC
ACCAGAAGGAGCGGAATTATCATCATATTAATCAATTACCTGAGCAAAAG
CAGAGGCGAATTATTCATGAAATTGCGTAGATTTTCAGGTTTAACGT
GGATCCCCGGGTACCGAGAACATCGGGAGAAACAATAACG
CAGATGAATATACAGTAACAGTACCTTTTAAGAATTCGTAATCATGGTCA
CACGTAAAACAGAAATAAAATGATTATCAGATG
TAGCTGTTTCCTGTGTGAAAACCATATCAAAATTATTTG
TTCTGAATAATGGAAGGGTTAGAACCTGTTATCCGCTCACAATTC
TAATGAGTGAGCTAACTCACATTAATTGCAATATAATCCTGATTGTTTGGATTATAC
ATGGCAATTCATCAACGTATTAAATCCTTTGCCCGAACG
TTATTAATTTTAAAAGTTTGAGTAATATCTTTAGGAGCACTA
AGTATTAGACTTTACAAACAATTCGACAACTCGCTAGGGCGCTGGCAAGT
AATGCGCCGCTACAGGGCGCGTACCGTCAATAGATAATACATTTGAGGATTTAGA
ACAACTAATAGATTAGAGAAATCAACAGTTGAAAGGA
ATCAATATCTGGTCAGTTGGCACTATGGTTGCTTTGACGAGCA
CGTATAACGTGCTTTCCTCGTACCTCAAATATCAAACCCTCA
AAAAATCTAAAGCATCACCTTATTAGTAATAACATCACTTGC
CTGAGTAGAAGAACTCAAACTGCTGAGAGCCAGCAGCAAATG
GCCTGCAACAGTGCCAAAAGGGACATTCTGGCC
AACAGAGATAGAACCCAGGTCAGTATTAACACC
GAAGATAAAACAGAGGTGAGGTTCTGACCTGAAAGCGTAAGAATACGTGG
CCCTAAAACATCGCCATTAAAATACCGAACGAACCACCAGCA
TTTGACGCTCAATCGTCTGAAACTTTAATGCGCGAACTGATAG
CACAGACAATATTTTTGAATGGCTATTAGTGGATTATTTACATTGGCAGATTC
ACCAGTCACACGACCAGTAATAAAATCGGCCTTGCTGGTAATATCCAGAACAA
TCAGTGAGGCCACCGAGTAAAACGCTCATGGAAATACCTACAT
TATTACCGCCAGCCATTGCAACAGGAAAAAGAGTCTGTCCATCACGCAAATTA
ACCGTTGTAGCAATACTTCTTTGTAGAATCAGAGCGGGAGCTAAACAGGAGGCCGAT
GTAGCGGTCACGCTGCGCAATCCTGAGAAGTGTTTTTATAA
TAAAGGGATTTTAGACAGGAACGGTACGCCAGAAGTAACCACCACACCCGCCGCGCTT
AAGCGAAAGGAGCGGGAGTTGCGCTCACTGCCC
GCTTTCCAGTCGGGAAAAGAAAGGAAGGGAAGA
AAAGCCGGCGAACGTGGCACCTGTCGTGCCAGCTGCATTAAT
TTTTTCTTTTCACCAGTGAGACGGGCAACAGATTTAGAGCTTGACGGGG
CGGAACCCTAAAGGGAGCCCCAGCTGATTGCCCTTCA
ACAAGAGTCCACTATTAGGTGCCGTAAAGCACTAAAT
CCCAAATCAAGTTTTTTGGGGTCAAAGAACGTGGACTCCAACGTCAAA
CCGCCTGGCCCTGAGAAGATGGCCCACTACGTGAACCATCA
GGGCGAAAAACCGTCTATCAGGGAATCCCTTATAAATCAAAAGA
ATAGCCCGAGATAGGGTTGAGGTTGTTCCAGTTTGGA
TGGTGGTTCCGAAATCGGGAGTTGCAGCAAGCGGTCC
CACACAACATACGAGCCGAAAAAAAAGGCGAAAATCCTGTTTGA
ACGCTGGTTTGCCCCAGCAGGCGGTTTGCGTATTGGGCGCCAGGGTGG
GAATCGGCCAACGCGCGGGGAGAAGAAGCATAAAGTGTAAAGCCTGGGGTGCC
CTTCTGGTGCCGGAAACCAGGCAAAGAAAACGAAAGGGGGATGTGCTGCAAGGCGATTAAGTTGGGT
TCGCTATTACGCCAGCTGCGCCATTCGCCATTCAGGC

Supplementary table 9. Staple strand sequences for folding the map of Scandinavia flat sheet.

GACCTCCTGGTTGTGTAAGCAACTCGTCGGTG
TCCACACAACATACGAGCCGGAAGCATTTCTCCGAACTCT
ATTTCACATAAATCAAAAGGGGGATGTGCTGCAAGGCGA
TGTAAAACGACGGCCATTGAATCGGCTGACGC
GGCACGAATATAGGGGCCAGTGCCAAGCTTGATACCGA
CAGTGCGGCCCTGCCATCAAAAGTAATGAGTAAACAGG
GGCAAAGCGCCATTCGAATTCCCAGTCACGACGT
TTAAGTTGGGTAACGCCAGGGTTCATTCAGGCTGCGCAACTGTTGGG
CCAGCTGGCGTAAAGTGTAAAGCCTGGGGTGCCTAATGAGTGAG
GAATCGGCCAACGCGCGGGGAGAGGCGGTTTGCGTATTGTCGCTATTACG
AAGGGCGATCGGTGCGGGCCTCTGACGACGACAGTATCGGCCTCAGGAAGAT
GATTCTCCGTGGGAACAAAAACTGGTGCCGGAAACCA
CGCACTCCAGCCAGCTTTCCGGCACCGCTAAACGGCGGATTGACCGTAATGGG
ATCTGCCAGTTTGAGGAAAGCGCCAGGGTG
TTAGAGCTTGACGGGGAAAGCCGGCGCGCATCGTAACCGTGC
ATAGGTCACGTTGGTGTAGATGGTTCCTGTAGCCAGCTTTCA
TTGTTAAAATTCGCATAAAGAGTAACAACCCGTCG
TCAACATTAAATGTGAGCTAAATTTTTGTTAAATCAG
TAATTCGCGTCTGGCCAACGTGGCGAGAAAGGAAGGGAAG
GCTGCGCGTAACCACCACACCCGGGAACGCCATCAAAAA
CTCATTTTTTAACCAATACGTAAAACTAGCATGT
CAATCATATGTACCCCATGTAAACGTTAATATT
AAGCAAATATTTAAGTTGATAATCAGA
AGTAATGTGTAGGTAAAAAGGAAGATTGTAT
AAAGCCCCAAAAACATTGCCTGAGAGTCTGGAGCAAA
CAAGAGAATCGATGAACGGTAATCCGCGCTTAATGCGCC
TTTTGAGAGATCTACAAAGGCTATCAGGTGATTCAAAAGGGTGAGAAA
GCTACAGGGCGCGTACGATAAATTAATGCCGGAGAGGGTAGCTAT
TTCAACCGTTCTAGCTTTAAAGGGATTTTAGACAG
CACCGAGTAAAAGAGTCTGTCCATCACGCCACCATCAATATGATA
GGCCGGAGACAGTCAAATACCTTTATTTCAACGCAAGGATAAA
AGGCAAAGAATTAGCAAAATTAAATTAAATGCAATGCCTG
AATTTTTAGAACCCTCATATATTAAGCAATAAAGCCTCAGAG
TGTAATACTTTTGCGGGAGAAAAATTAACCGTT
ACACTAAAACACTCATCTTTGGTACCAAAAACATTATGACCC
CATAAAGCTAAATCGGTTAGGTGGCATCAATTCTACT
TTTAGTTTGACCATTAGATACATCCAATAAATCATACAGGCA
AATAGTAGTAGCATTAACATTTCGCAAATGG
TGGGGCGCGAGCTGAAACCCCCAGCGATTA
ATCGCCTGATAAATTGTGTCGAAATAGCTATATTTTCATT
TCAATAACCTGTTAGTACCTTTAATTGCTCCTTTTGATAA
GAGGTCATTTTTGCGGATGGCTTAGAACCAATTCTGCGAACGAGTAGA
TTCATTCCATATAACAGTTGATTGCTTAATTGCTGAATATAATGCTG
GAATGACCATAAATCAAAAAACTAAAGTACGGTGTCTGGAAGT
TAGCTCAACATGTTTTAAATATGGCAAACTCCAACA
GGTCAGGATTAGAAAAATCCGCGACCTGCTCC
TTCGAGCTTCAAAGCGAACCAGACCGGAAAAATCAGGTCTTTACCCTGA
ATGTTACTTAGCCGGAACCCGAAAGACTTCAAATATCGCGTTTTAA
AAAGATTAAGAGGAAGAAATAGTAAAATGT
ATTCATTGAATCCCCCTCAAATGCTTAAAAGCGGATTGCATCAA
CTATTATAGTCAGAAGCAATAAACAGTTCAGAAAACGA
ACGAGGCATAGTAAGAGCAACACTATAGTCCAATACTGCGGAATCGTCATAAAT
TTAGACTGGATAGCATAACCCTCGTTTACCAG
AGAAGTTTTGCCAGAGGGGGTAGAGGCGCAGACGG

AGGACAGATGAACGGTGTACAGAATAGCGAGAGGCTTTTGCAAA
ACGACGATAAAAACCAAAAGAAACACCAGAACGA
GTAGTAAATTGGGCTTTGCAGATACATAACGCCAAAAGGAATT
AGGAATACCACATTCAACGAGATGGTTTAATTTCAAC
TAAGAACTGGCTCAGATTCATCAGTTGAGATTT
AACAACATTATTACAGGTAATTATACCAGTCAGGACGT
CAGACAGCCCTCATAGTTATAATAAAACGAACTAACGG
TGGGAAGAAAAATCTACGACAACTAAAGGAATTGCGAATAAT
AATTTTTTCACGTTGAAAATCTCACCTTATGCGATTT
TTTAATCATTGTGAATTATCAACGTAACAAAGCTGCTCATTC
AGTGAATAAGGCTTGCCCTGACGCCAGGCGCATAGGCTGGCT
ATATTCATTACCCAAAAAAAAAAAAGGCTCCAAAAG
TTAAACAGCTTGATACCGATAGTTGCGCCATCTTGACAAGAACCGG
GACCTTCATCAAGAGTAATTTGAGGACTAAAGACTTTTTCATGAG
GAAGTTTCCATTAAACGGGTAAAATAAACCGAACTGACCAACTTTGAAAG
TCAATCATAAGGGCAAAGTACAACGGAGATTTGTATC
TACCAAGCGCGAAAGTAATGCCACTAC
GTAGCAATACAAAACGAAAGAGGCAAAAGAAT
GAAGGCACCAACCAACAGCATCGGAACGAGGGT
AGCAACGGCTACAGAGGCAAAACAATGACAACAACCATCG
CGCTTTTGCGGGATCGTCACCCTCAGCAGCGAAAATTTGATTAGTAATAACATC
GGTAATATCCAGAACAATATTCGGTCGCTGAGGCTTGCAGGGAGTTAAAGGC
CCCACGCATAACCGATATAACATAATCAAAATCACC
GGAACCAGAGCCACCATTTATCAGCTTGCTTTCGAGGTGAATTTC
GAGCCTTTAATTGTATCGAGTTTCAGCGGAGT
GAGAATAGAAAGGAGCGTAACGATCTAAAGTT
GATTTTGCTAAACAACTTTCAACAGAACCGCCTCCCT
GCCACCACCCTCAGAGCCATTAGTAAATGAATTTTCTGTATGG
TTGTCGTCTTTCCAGACGCAACGCCTGTAGCATTCCA
TCACCAGTACAAAAAAGCCCAATAGGA
GTGTATCACCGTACTCAGGAGGTTTAAAAAAAACACTGAGTTTCG
ACCCATGTACCGTATACCGCCACCCTC
CCACCCTCATTTTCAGGGATAGCGCCACCAGAACCACCACCAGAGCC
GATTGGCCTTGATATCAGAACCGCCACCCTCAGAGCCA
AGAACCGCCACCCTTAATGCCCCCTGCCTATTTCGGAACC
TATTATTCTGAAACATGAAAGTATTAAGGTTGATATAAGTATAGCCCGGAATAG
GGCGGATAAGTGCCGTCGAAAGAGGCTGAGACTCCTCAA
CACCCTGAACAAAGTCAGAAAAGGGGTTTTGCTCAGTACCA
GAGAAGGATTAGGATTAGGCTTTTGATGATACAGGAGTGTACTGGTAATAAGTTTTAA
CGGGGTCAGTGCCTTGAGTAACAGTGCCCGTATAAACAGTCACAAACAAATAAATCCT
TTCCAGTAAGCGTCATACATGAGGGTAATTGAGCGCTAAT
CAAGAAACAATGAAATAGCAATAGCTATCGCGCAGTCTCTGAATTTACCG
CATTAAAGCCAGAATGGAAGTAGAAAATACATACATAAAGGTGGCAAC
ATATAAAAGAAACGCAAAGACACCACGGAAAGGCAGGTCAGAC
GCCGCCAGCATTGACAGGAGGTTTATTCATTAAAGGTGAATTAT
CACCGTCACCGACTTGAGCCAACAGAACCGCCACCCTCAGA
CAGAGCCGCCACCAGCGCGTTTTCATCGGCATTTTCGGTCAT
AGCCCCCTTATTAGCGTTTGCCATCTTTTTACCGCCAGCCATTGC
GTTTGCCTTTAGCGTCAGACTGTTTTGGGAATTAGAGCCAGC
AACAGGAAAAACGCTCCGTAATCAGTAGCGACAGAATCAA
ACCAATGAAACCATCGATAGCAGCACACCAGCAGAAGATAAAACA
TGCCACGCTGAGAGCCAGATTACCATTAGCAAGGCCGGAAACGTC
AAAATCACCAGTAGCACCAGAGGGAAGGTAAA
TATTGACGGAAATATAAGTTTATTTTGTCACAA
GGGCGACATTCAACCGATTGAGGAAGCAAATGAAAAATCT
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