Supplementary Information for

Programming DNA origami patterning with non-canonical DNA-

based metallization reactions

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Supplementary Figure 1. Schematic illustration of Cu plating on DNA origami to form the *digit 8*.



Supplementary Figure 2. Cu plating on DNA origami of *digit 8.* **a**, Schematic illustration of the formation of *digit 8* on DNA origami. **b**, AFM image showing the DNA template. **c**, AFM image showing the metal nanocircuit of *digit 8* pattern on DNA origami. Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Supplementary Figure 3. Control AFM measurements of Cu plating on DNA origami. a, AFM image of copper plating reaction on a flat origami with only osDNA. b, AFM imgae showing no metallization on pcDNA without AscH. c, AFM imgae showing no metallization on pcDNA without CuCl₂. Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Supplementary Figure 4. Effect of reaction time on Cu metallization on DNA origami. The AFM images showed the copper plating on DNA origami of a *digit 8* pattern. Scale bar: 200 nm.



Supplementary Figure 5. Effect of Cu^{2+} concentration on Cu metallization. The concentrations for a-c were 0.1, 0.5 and 1 mM respectively. For d-f, the concentrations were 2, 4 and 10 mM respectively. The concentrations for g-o were 20, 30, 40, 50, 60, 70, 80, 90 and 100 mM respectively. Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Supplementary Figure 6. Cu metallization with a high concentration of Cu^{2+} (100 mM). a, Copper metallization on a DNA origami of *digit 8* pattern. b, Metallization on a flat DNA origami without any pcDNA. Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Supplementary Figure 7. Calculation of the theoretical proportion of the metalized area. a, Schematic illustration of the metallization on the *digit 8* pattern. b, Illustration of the calculation method 1: the total number of staples is 216 and the number of pcDNA is 75, therefore the proportion is 75/216 = 34.72%. c, Illustration of the calculation method 2: the size of this origami is 7000 nm² and the size of the metalized area is 2813 nm², therefore the proportion is 2813/7000 = 40.19%.



Supplementary Figure 8. Number effects of pcDNA strands per site on metallization. a, Schematic representation of the origami canvas with seven predefined sites containing one, two and three pcDNA strands, respectively. Each single strand contained 15 bases. b-c, AFM measurements for before (b) and after (c) Cu metallization. Scale bars: 200 nm.



Supplementary Figure 9. Cu metallization on *miniaturized digit 8* pattern. Scale bars: 200 nm (large area image) and 25 nm (higher magnification images).



Supplementary Figure 10. Cu plating on a *seven-dot* pattern in a positive mode (a) and Cu plating on a *rectangular block* pattern in a negative mode (b). Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Counted origami	Theoretical number	Found number of	Yield of Cu			
	of dots	dots	metallization			
57	399	383	95.99%			

Supplementary Figure 11. Counting metallization yield on *seven-dot* pattern. The rectangle panes and circles highlighted the DNA origami contours and the **metallized dots after Cu plating process**. Scale bar: 200 nm.



Counted origami	Theoretical number	Found number of	Yield of Cu		
	of dots	dots	metallization		
81	243	219	90.12%		

Supplementary Figure 12. Counted yield of Cu metallization on *three-dot* pattern. The triangle panes and circles highlighted the DNA origami contours and the metallized dots after Cu plating process. Scale bar: 200 nm.



Supplementary Figure 13. TEM measurement of Cu metallization on triangular origami. a, TEM image. b, STEM image. Scale bars: 100 nm.



Supplementary Figure 14. SEM measurement of Cu metallization on triangular origami. a, Schematic illustration of the prolonging of staple strands and the plating process on DNA origami. b-c, SEM images showing the DNA origami and the metallization before and after plating. Scale bars: 200 nm.



Supplementary Figure 15. X-ray Photoelectron spectra of the Cu and Ag metallization samples. a, XPS spectrum of Cu2p region (raw data, black curve) and the fitting model (pink curve) showing that the sample included three components: Cu(0) (dark cyan curve, 55.2%), Cu(II) (orange curve, 40.9%) and Cu(I) (magenta curve, 4.0%) species¹. b, XPS spectrum of Ag3d region (raw data, black curve) and the fitting model (pink curve) showing that the sample included two components: Ag(0) (dark cyan curve, 86.0%) and Ag(I) (orange curve, 14.0%) species².



Supplementary Figure 16. Ag metallization on DNA origami of *digit 8* pattern. a, Schematic representation of the Ag metallization process. The mica-attached DNA origami of *digit 8* pattern was treated with the plating solution of AgNO₃ and NH₂OH. **b-c**, AFM images and cross-section analysis measured before (b) and after (c) Ag metallization. Scale bars: 200 nm (large area images) and 25 nm (higher magnification images).



Supplementary Figure 17. Fabricating nano-PCB mimics with DCIMP. a, A sevensegment digit 8 design was employed to fabricate nano-PCB mimics on a rectangular origami. To design an alphabet d pattern, we placed pcDNA on selected segments B, C, D, E and $F(d=[B, C, D, E, F] \subset \text{Seg}=[A, B, C, D, E, F, G])$. b, To show the generality, we fabricated digits from 0 to 9 and several typical alphabets, as shown in corresponding AFM images.



Supplementary Figure 18. Cu metallization of numerals based on nanosized *seven-segment display* pattern. AFM images showed metallized numerals from θ to 9. Scale bars: 200 nm.



Supplementary Figure 19. Cu metallization of alphabets based on nanosized sevensegment display pattern. AFM images showed metalized alphabets d, n, A and C, u. Scale bars: 200 nm.



Supplementary Figure 20. Thermodynamic simulation and UV absorbance at 260 nm measurement of the short DNA sequences. a, Thermodynamic simulation of the sequences using NUPACK software with 0.05 M Na⁺, 0.012 M Mg²⁺ at 25 °C. The Δ G of the double strands of the 8-base sequences was -10.97 kcal mol⁻¹. b, UV absorbance measurement at 260 nm of the sequences. For clear UV absorbance curve, the concentration of the strands was set at 6 μ M in 1 × TA-Mg²⁺ (pH 8.0) buffer. The rate of increasing temperature was set at 1 °C min⁻¹. Tm of the sequences was 37.3 °C according the UV absorbance curve³.



Supplementary Figure 21. EDX measurement of the metallized pattern with Ag and Cu. The elemental peaks of Cu and Ag showed that both of them were presented.

Ritin
R-210g R-510g R-510g R-110g R-10g R310g R310g R510g R510g R510g
R-9121
R-9146
1 12/14 1 ISSR-544 1 ISSR-344 1 I
R-9160 SSR/161 SAR-7160 R-5160 R-3160 SSR/166 SSR/166 R160 R360 R360 SSR/161 SAR7160
Reter TR-Ster TR-Ster TR-tter TR-tter TR-tter TR-tter TR-tter
R-9180 SSR/188 SSR-7180 R-5180 R-5180 R-3180 SSR/1180 SSR/1180 R5180 R5180 SSR/1181
The start the st
R.9110e SSR.71106 SR.7110e R.5110e R.5110e SSR.1110e SSR.1110e SSR.1110e R.110e R.110e R.110e
TRANCE V C 101631 C 101631 C V C 101631 C 101631 C 101631 C V
R-91120 SSR/1121 SR-71120 R-51120 R-51120 R-51120 SSR/1121 SSR/1121 R11120 R31120 R51120 SSR/1121 SSR/1120
TR-1121 TR-1121 TR-1121
R-9114e SSR/1141 SR-7114e R-5114e R-5114e SSR/1114e SSR/1114e SSR/114e R5114e SSR/114e
Rettat
R-91160 SSR-71160 _ SKR-51160 _ SKR-31160 _ SKR-11160 SSR11160 _ SKR1160 _ SKR31160 _ SKR51160 _ SKR51160
Agtier, Agtier, Agtier, Agtier, Agtier, Agtier, Relier, Sector
R-9118e R-7118e StR-5118e StR-3118e StR-1118e StR-1118e StR-1118e StR-3118e R7118e
R7/118/ SSR-5118/ SSR-3118/ SSR-3118/ SSR-3118/ SSR-3118/ SSR-3118/ SSR-3118/
R-9120e R-7120e R-5120e R-9120e R-1120e R11201 R11200 R3120e R5120e R7120e
R7/201 R5/201 R-1/201 R-1/201 R3/201 R3/201 R5/201 R5/201 R5/201
R-9122e R-7122e R-5122e R-1122e R1122e R1122e R122e R3122e R5122e R5122e R5122e
TR-1/221 TR-5/221 TR-5/221 TR-1/221 R3/221 TR-1/221
R-9t24e R-7t24h R-5t24h R-3t24h R-1t24h R1t24h R3t24h R5t24h R7t24h

Supplementary Figure 22. Schematic representation of *seven-segment display* on rectangular DNA origami.

	_		_		_	-	_		_		_		_	_
R-7t0g	R-5t0g	R-3t0g		R-1t0g		R1t0g	2	R3t0g	- 2	R5t0g	-2	R7t0g		R9t0g
R-9t2i R-7t2e	R-51	2e 🔁	R-3t2e		R-1t2e	R1t2f	R1t2e		R3t2e		R5t2e		R7t2e	
R-7t2f	R-5t2f	R-3t2f		R-1t2f		\mathbf{N}	1	R3t2f	1	R5t2f		A712f		R9t2i
R-9t4e EQR-7t4	e 🦰 R-51	4e 🟳	R-3t4e		EBR-1t4e	EDR1t4f	R1t4e		R3t4e		R5t4e		R7t4e	
R-7t4f	R 5t4f	R-3t4f		R-1t4f	-		1	R3t4f	→	R5t4f		EDR7t4f		R9t4e
R-9t6e	ie 🚬 R-51	:6e 🔁	R-3t6e		R-1t6e	R1t6f	R1t6e		R3t6e		R5t6e		R7t6e	7
R-7t6f	EDR-5t6f	R-3t6f		R-1t6f				R3t6f		R5t6f		R7t6f		R9t6e
R-9t8e R-7t8e	R-51	8e 🗾	R-3t8e		R-1t8e	R1t8f	R1t8e		R3t8e		R5t8e		R7t8e	
R-7t8f	R-5t8f	R-3t8f		R-1t8f			-	R3t8f	▲	R5t8f		R7t8f	-	R9t8e
R-9t10e R-7t10e	R-5	10e 🚬	R-3t10e		R-1t10e	R1t10f	R1t10e		R3t10e		R5t10e		R7t10e	_
R-7t10f	R-5t10f	R-3t10f		R-1t10f				R3t10f		R5t10f		AZt10f	1	R9t10e
R-9t12e R-7t12e	R-5	t12e 📃	R-3t12e		EBR-1t12e	EDR1t12f	R1t12e		R3t12e		R5t12e		R7t12e	
R-7t12f	R-5t12f	R-3t12f		R-1t12f			1	R3t12f		R5t12f		EDR7t12f	1	R9t12e
R-9t14e R-7t14e	R-51	14e 🗖	R-3t14e		R-1t14e	R1t14f	R1t14e		R3t14e		R5t14e		R7t14e	1
R-7t14f	R-5t14f	R-3t14f	-	R-1t14f				R3t14f		R5t14f	-	R7t14f		R9t14e
R-9t16e	6e R-5	t16e	R-3t16e		R-1t16e	R1t16f	R1t16e		R3t16e		R5t16e		R7t16e	
R-7t16f	R 5t16f	R-3t16f		R-1t16f				R3t16f		R5t16f	-	R7t16f		R9t16e
R-9t18e ERR-7t1	8e R-5	t18e 🚬	R-3t18e		R-1t18e	R1t18f	R1t18e		R3t18e		R5t18e		R7t18e	_
R-7t18f	EDR-5t18f	R-3t18f	-	R-1t18f			-	R3t18f	-	R5t18f	-	N7t18f		R9t18e
R-9t20e R-7t20e	R-5	t20e	R-3t20e		EDR-1t20e	EDR1t20f	R1t20e		R3t20e		R5t20e		R7t20e	
R-7t20f	R-5t20f	R-3t20f	-	R-1t20f			•	R3t20f		R5t20f	-	EDR7t20f		R9t20e
R-9t22e R-7t22e	R-5	t22e	R-3t22e		R-1t22e	R1t22f	R1t22e		R3t22e		R5t22e		R7t22e	
R-7t22f	R-5t22f	R-3t22f	•	R-1t22f		цĒ-	-	R3t22f		R5t22f	•	R7t22f	•	R9t22e
R-9t24e R-7t24h	R-5t24h	R-312	Ab	P. 1	1241	R1t	24h	R3t2	4h	R5t2	4h	R7t2	4h	
		K-312		K-1	L2411			Kötz				K/12		

Supplementary Figure 23. Schematic representation of *eight-dot* pattern on rectangular DNA origami with varied amount of protruding ssDNA strands at each site.



Supplementary Figure 24. Schematic representation of *miniaturized digit 8* pattern on tall rectangular DNA origami.

R-7t0g R-5t0g R-3t0g R-1t0g	R1t0g R5t0g R7t0g R9t0g
R-9t2i R-7t2e R-5t2e SBR-3t2e R-1t2e	R112f R1t2e SQR3t2e R5t2e R7t2e
R-712f R-512f SQR-312f R-112f	
R-9t4e R-7t4e R-5t4e R-3t4e R-1t4e	R1t4f R1t4e R3t4e R5t4e R7t4e
R-7t4f R-5t4f SDR-3t4f R-1t4f	SDR3t4f R5t4f R7t4f R9t4e
R-9t6e R-7t6e R-5t6e R-3t6e R-1t6e	R1t6f R1t6e R3t6e R5t6e R7t6e
R-7t6f R-5t6f R-3t6f R-1t6f	R3t6f R5t6f R7t6f R9t6e
R-9t8e R-7t8e R-5t8e R-3t8e R-1t8e	R118f R1t8e R3t8e R5t8e R7t8e
R-718fR-518fR-318fR-118f	R3t8f R5t8f R7t8f R7t8f
R-9t10e SQR-7t10e R-5t10e R-3t10e SQR-1t10e	R1t10f R1t10e R3t10e SQR5t10e R7t10e
R-7t10f R-5t10f R-3t10f R-1t10f	R3t10f 7 R5t10f 7 R5t10f 7 R9t10e
R-9t12e SDR-7t12e R-5t12e R-3t12e SDR-1t12e s	SDR1t12f R1t12e R3t12e SQR5t12e R7t12e
R-7t12f SDR-5t12f R-3t12f R-1t12f	R3t12f R5t12f SDR7t12f R9t12e
R-9t14e R-7t14e R-5t14e R-3t14e R-1t14e	R1t14f R1t14e R3t14e R5t14e R7t14e
R-7t14f R-5t14f R-3t14f R-1t14f	R3t14f 7 R5t14f 7 R7t14f 7 R9t14e
R-9t16e R-7t16e R-5t16e R-3t16e R-1t16e	R1t16f R1t16e R3t16e R5t16e R7t16e
R-7t16f R-5t16f R-3t16f R-1t16f	R3t16f R5t16f R7t16f R9t16e
R-9t18e R-7t18e R-5t18e R-3t18e R-1t18e	R1t18f R1t18e R3t18e R5t18e R7t18e
R-7t18f R-5t18f R-3t18f R-1t18f	R91186
R-9t20e R-7t20e R-5t20e SBR-3t20e R-1t20e	R1t20f R1t20e SBR3t20e R5t20e R7t20e
R-7t20f R-5t20f SDR-3t20f R-1t20f	SQR3120f R5120f R7120f R9120e
R-9t22e R-7t22e R-5t22e R-3t22e R-1t22e	R1122f R1122e R3122e R5122e R7122e
R-7122f R-5122f SDR-3122f R-1122f	SDR3t22f TR5t22f R7t22f R9t22e
R-9124e R-7124h R-5124h R-3124h R-1124h	R1124h R3124h R5124h R7124h

Supplementary Figure 25. Schematic representation of *seven-dot* pattern on rectangular DNA origami.

←	t-5r0g	t-3r	0g	t-1	r0g	t1r0g		t3r0g		t5r0g		t7r0f
				4	-			G			-	
t-7r2i	t-5r2f t-5r2e	t- <mark>3r2f</mark>	t-3r2e	t- <mark>1r2f</mark>	t-1r2e	t1r2f	t1r2e	t3r2f	t3r2e	t5r2f	t5r2e	t7r2f
t-7r4e	t-5r4f t-5r4e	t-3r4f	t-3r4e	t- <mark>1r4f</mark>	t-1r4e	t <mark>1r4f</mark>	t1r4e	t3r4f	t3r4e	t5r4f	t5r4e	t7r4f
t-7r6e	t-5r6f t-5r6e	t-3r6f	t-3r6e	t-1r6f	t-1r6e	t <mark>1r6f</mark>	t1r6e	t3r6f	t3r6e	t5r6f	t5r6e	t7r6f
							- 2		- 7			
t-7r8e	t-5r8f t-5r8e	t-3r8f	t-3r8e	t-1r8f	t-1r8e	t1r8f	t1r8e	t3r8f	t3r8e	t <mark>5r8f</mark>	t5r8e	t7r8f
			-2				-2		- 7		Ē	
t-7r10e	t-5r10f t-5r10e	t-3r10f	t-3r10e	t-1 <mark>r10f</mark>	t-1r10e	t1r10f	t1r10e	t3r10f	t3r10e	t5 <mark>r10f</mark>	t5r10e	t7r10f
			-2	5			\sim		_2		-72	
t-7r12e	t-5r12f t-5r12e	t-3r12f	t-3r12e		\sim	\sim		t3r12f	t3r12e	t5r12f	t5r12e	t7r12f
			-2	~	\sim	\sim	\sim		-2			
t-7r14e	t-5r14f t-5r14e	t-3r14f	t-3r14e		\sim	\sim		t3r14f	t3r14e	t5r14f	t5r14e	t7r14f
	<u> </u>		-2	~	\sim	\sim	\sim		-2		Ē	
t-7r16e	t-5r16f t-5r16e	t-3r16f	t-3r16e		\sim	\sim	~	t3r16f	t3r16e	t5r16f	t5r16e	t7r16f
	<u> </u>			~	\sim	\sim	\sim		-7			
t-7r18e	t-5r18f t-5r18e	t-3r18f	t-3r18e		\sim	\sim	~	t3r18f	t3r18e	t5r18f	t5r18e	t7r18f
			Ē	~	\sim	\sim	\sim		-7			
t-7r20e	t-5r20f t-5r20e	t-3r20f	t-3r20e	~	\sim	12	\sim	t3r20f	t3r20e	t5r20f	t5r20e	t7r20f
					-6		2		-2	<u> </u>	È	
t-7r22e	t-5r22f t-5r22e	t-3r22f	t-3r22e	t-1r22f	t-1r22e	t1r22f	t1r22e	t3r22f	t3r22e	t5r22f	t5r22e	t7r22f
					÷						È	
t-7r24e	t-5r24f t-5r24e	t-3r24f	t-3r24e	t-1r24f	t-1r24e	t1r24f	t1r24e	t3r24f	t3r24e	t5r24f	t5r24e	t7r24f
			4.2.00		<u> </u>					<u> </u>	Ē	
t-7r26e	t-5r26f t-5r26e	t-3r26f	t-3r26e	t-1r26f	t-1r26e	t1r26f	t1r26e	t3r26f	t3r26e	t5r26f	t5r26e	t7r26f
				<u> </u>	4 4 2 0 2			<u> </u>		<u> </u>	15 000	
t-7r28e	t-5r28f t-5r28e	t-3r28f	t-3r28e	t-1r28f	t-1r28e	t1r28f	t1r28e	t3r28f	t3r28e	t5r28f	151286	t7r28f
		L 2=205	+ 2x20c	L 4=201	4.4+20	44-205	44.000	40-005	42+20+		45+204	47-201
t-7r30e	t-5r30f	t-3r30f	-31306	t-1r30f	<u>11-11</u> 300	117301	11r30e	t3r30f		15r30f	15F3UE	1/130]
				<u>→</u> _		-		<u>→</u> _		-		╘┓
t-7r32e	t-5r32h		t-3r32h	t	-1r32h		t1r32h		t3r32h		t5r32h	

Supplementary Figure 26. Schematic representation of *rectangular block* pattern on tall rectangular DNA origami.



Supplementary Figure 27. Schematic representation of *three-dot* pattern on triangular DNA origami.



Supplementary Figure 28. Schematic representation of triangle pattern on triangular DNA origami for STEM measurements of Cu and Ag elementals.



Supplementary Figure 29. Schematic representation of the TdT catalyzed elongation of poly-dA overhangs on one arm of the triangle.



Supplementary Figure 30. Schematic representation of *C* pattern on tall rectangular DNA origami. The dashed lines on the right were used for the assembly of the origami.

t7r0f	t5r0g	t3r0g		t1r0g	t-1	r0g	t-3	r0g	t-5	r0g	
				-							
	t5r2e t5r2f	t3r2e t3r2f	t1r2e	t1r2f	t-1r2e	t-1r2f	t-3r2e	t-3r2f	t-5r2e	t-5r2f	t-7r2i
L7r2f				-		~				-	
	t5r4e t5r4f	t3r4e t3r4f	t1r4e	t1r4f	t-1r4e	t-1r4f	t-3r4e	t-3r4f	t-5r4e	t-5r4f	L-1146
t7r4f							5_				
	t5r6e t5r6f	t3r6e t3r6f	t1r6e	t1r6f	t-1r6e	t-1r6f	t-3r6e	t-3r6f	t-5r6e	t-5r6f	t-7r6e
L7r6f		-	5_						5_		L-7r8e
	t5r8e t5r8f	t3r8e t3r8f	t1r8e	t1r8f	t-1r8e	t-1r8f	t-3r8e	t-3r8f	t-5r8e	t-5r8f	
t7r8f	도 구		5				5		5		
	t5r10e t5r10f	t3r10e t3r10f	t1r1 <u>0e</u>	t1r10f	t-1r10e	t-1r10f	t-3r10e	t-3r10f	t-5r10e	t-5r10f	t-7r10e
L7r10f	<u> </u>	5-2	5				5		5		L-7r12e
	t5r12e t5r12f	t3r12e t3r12f	t1r12e	t1r12f	t-1r12e	t-1r12f	t-3r12e	t-3r12f	t-5r12e	t-5r12f	
t7r12f		$\overline{\langle} \rightarrow$	5				5	\mathbf{P}	<u> </u>		5
	t5r14e St5r14f	St3r14e t3r14f	t1r14e	t1r14f	t-1r14e	t-1r14f	t-3r14e	St-3r14f	St-Sr14e	t-5r14f	t-7r14e
L7r14f		$\overline{\langle}$	5								L-7r16e
	t5r16e St5r16f	St3r16e t3r16f	t1r16e	t1r16f	t-1r <u>16e</u>	t-1r16f	t-3r16e	St-3r16f	St-5r16e	t-5r16f	
t7r16f			S_	_ —							لين
	t5r18e St5r18f	Star18e t3r18f	t1r18e	t1r18f	t-1r <u>18e</u>	t-1r18f	t-3r18e	St-3r18f	St-Sr18e	t-5r18f	t-/r18e
L7r18f			5				4.2-20-				L-7r20e
47-206	t5r20e St5r20f	Star20e t3r20f	t1r20e	t1r20f	t-1r20e	t-1r20f	t-3rzue	St-3r20f	St-Sr20e	t-5r20f	
trizut			<u> </u>				4.0-00-			<u> </u>	47-00-
17-0051	torzze Storzzt	St&r22e t3r22f	tirzze	tirzzf	t-1r22e	t-1r22f		St-3r22f	St-5r22e	t-5r22f	t-/122e
L/IZZI	t5r240 845+246		000.04	41+246		4-246	010-24	CL 2-24			L-7r24e
17-246	3(3)241	Starz4e t3rz4r	511/248	111241	51-17240	1-11/241	51-31240	51-31241	St-3r24e	t-5r24f	
1/1241	t5r26a St5r26f	Star266 St3r26f	SM r260	St1r26f	811-260	St-1r26f	St-8r26e	St-3r26f	St-Sr26e	E-266	t-7r26e
17r26f				311201		-		5		-51201	
	t5r28e t5r28f	t3r28e t3r28f	t1r28e	t1r28f	t-1r28e	t-1r28f	t-3r28e	t-3r28f	t-5r28e	t-5r28f	L-7r28e
t7r28f						5				5	
	t5r30e t5r30f	t3r30e t3r30f	t1r30e	t1r30f	t-1r30e	t-1r30f	t-3r30e	t-3r30f	t-5r30e	t-5r30f	t-7r30e
L7r30i				7		5		5		5	
	t5r32h	t3r32h	t1r32h		t-1r32	h	t-3r32h	_	t-5r32h	_	t-7r32e

Supplementary Figure 31. Schematic representation of u pattern on tall rectangular DNA origami. The dashed lines were used for the assembly of the origami.

t7r0f	t5r0g	t3r0g	t1r0g	t-1r0g	t-3r0g	t-5r0g	→
						5	
5	t5r2e t5r2f	t3r2e t3r2f	t1r2e t1r2f	t-1r2e t-1r2f	t-3r2e t-3r2f	t-5r2e t-5r2f	
t7r2f						5	
	t5r4e t5r4f	Bt3r4e t3r4f	Extr4e t1r4f	Et 1r4e t-1r4f	Et 3r4e t-3r4f	t-5r4e t-5r4f	t-7r4e
L7r4f			< \⊨				-7r6e
5	t5r6e Et5r6f	Et3r6e Et3r6f	Ex1r6e Et1r6f	Et-1r6e Et-1r6f	Ex3r6e Et-3r6f	E 5r6e t-5r6f	-
t7r6f						<u> </u>	
	t5r8e Et5r8f	Et3r8e t3r8f	t1r8e t1r8f	t-1r8e t-1r8f	t-3r8e Et-3r8f	E 5r8e t-5r8f	t-7r8e
L7r8f	5 \>						L-7r10e
	t5r10e Et5r10f	Etsr10e t3r10f	t1r10e t1r10f	t-1r10e t-1r10f	t-3r10e Et-3r10	f Et-Sr10e t-5r10f	
t7r10f							
	t5r12e Et5r12f	Et3r12e t3r12f	t1r12e t1r12f	t-1r12e t-1r12f	t-3r12e Et-3r12f	Et-6r12e t-5r12f	t-7r12e
L7r12f					$\langle \langle \rangle$		L-7r14e
- 5-	t5r14e Et5r14f	Etar14e t3r14f	Etyr14e t1r14f	Et 1r14e t-1r14f	Et gr14e Et-3r14f	f Et-Sr14e t-5r14f	
t7r14f	$ \langle 2 $		$\langle \langle \cdot \rangle$		$\overline{\langle} \langle 2$	$\overline{\overline{}}$	
	t5r16e Et5r16f	Et3r16e Et3r16f	Ethr16e Et1r16f	Et 1r16e Et-1r16f	Et-Sr16e Et-3r16f	f Et-5r16e t-5r16f	t-7r16e
L7r16f	5 \2						L-7r18e
- 5-	t5r18e Et5r18f	Etsr18e t3r18f	t1r18e t1r18f	t-1r18e t-1r18f	t-3r18e Et-3r18f	f Et-5r18e t-5r18f	
t7 <u>r18f</u>							5
	t5r20e Et5r20f	Etsr20e t3r20f	t1r20e t1r20f	t-1r20e t-1r20f	t-3r20e Et-3r20	f Et-Sr20e t-5r20f	t-7r20e
L7r20f							L-7r22e
	t5r22e Et5r22f	Et3r22e t3r22f	t1r22e t1r22f	t-1r22e t-1r22f	t-3r22e Et-3r22f	f Et-5r22e t-5r22f	
t7r22f							
	t5r24e Et5r24f	Etsr24e t3r24f	t1r24e t1r24f	t-1r24e t-1r24f	t-3r24e Et-3r24f	Et-Sr24e t-5r24f	t-7r24e
L7r24f							L-7r26e
	t5r26e Et5r26f	Et3r26e t3r26f	t1r26e t1r26f	t-1r26e t-1r26f	t-3r26e Et-3r26	Et-1/260 t-5r26f	
t/r26t							
1.7.000	torzee torzer	t3r28e t3r28f	t1r28e t1r28f	t-1r28e t-1r28f	t-3r20e t-3r28f	t-5r28e t-5r28f	t-/r28e
L/F28T	45-20- 45-204	42-20- 42-204	44-20- 44-206	4.4-20- 4.4-204	4.2x20a 4.2-206		L-7r30e
+7=201	torsue torsof	torsue torsuf	tir30e tir30f	t-1r30e t-1r30f	t-orsue t-orsof	t-pr30e t-5r30f	
1/130							ليح
	t5r32h	t3r32h	t1r32h) ^{t-1r32h}	t-3r32h	t-5r32h	t-7r32e

Supplementary Figure 32. Schematic representation of *A* pattern on tall rectangular DNA origami. The dashed lines were used for the assembly of the origami.



Supplementary Figure 33. Schematic representation of g pattern on tall rectangular DNA origami. The dashed lines were used for the assembly of the origami.

Supplementary Notes: DNA sequences:

For seven-segment display:

SSR-7t6f: GACCTGACGACATAGACTTGAGAGAGCGACCTTTGAAAAGAACTGGCTCATTATTTAATAAA SSR-7t8f: GACCTGACGACATAGACTTGAGAGAGCGACACGAACTAGCGTCCAATACTGCGGAATGCTTT SSR-7t10f: GACCTGACGACATAGACTTGAGAGAGAGCGACAAACAGTTGATGGCTTAGAGCTTATTTAAATA SSR-7t12f: GACCTGACGACATAGACTTGAGAGAGCGACTGCAACTAAGCAATAAAGCCTCAGTTATGACC SSR-7t14f: GACCTGACGACATAGACTTGAGAGAGCGACCTGTAATATTGCCTGAGAGAGTCTGGAAAACTAG SSR-7t16f: GACCTGACGACATAGACTTGAGAGAGCGACCATGTCAAGATTCTCCGTGGGAACCGTTGGTG SSR-7t4e: GACCTGACGACATAGACTTGAGAGAGCGACGCTCCATGAGAGGCTTTGAGGACTAGGGAGTT SSR-7t6e: GACCTGACGACATAGACTTGAGAGAGCGACCGATTTTAGAGGACAGATGAACGGCGCGACCT SSR-7t8e: GACCTGACGACATAGACTTGAGAGAGCGACACTGGATAACGGAACAACATTATTACCTTATG SSR-7t12e: GACCTGACGACATAGACTTGAGAGAGCGACCAAAATTAAAGTACGGTGTCTGGAAGAGGTCA SSR-7t14e: GACCTGACGACATAGACTTGAGAGAGCGACTCAGGTCACTTTTGCGGGGAGAAGCAGAATTAG SSR-7t16e: GACCTGACGACATAGACTTGAGAGAGCGACACCCGTCGTCATATGTACCCCGGTAAAGGCTA SSR-5t4f: GACCTGACGACATAGACTTGAGAGAGCGACTTTCATGAAAATTGTGTCGAAATCTGTACAGA SSR-5t18f: GACCTGACGACATAGACTTGAGAGAGCGACGTTTGAGGGGAAAGGGGGATGTGCTAGAGGATC SSR-5t2e: GACCTGACGACATAGACTTGAGAGAGCGACATATATTCTTTTTCACGTTGAAAATAGTTAG SSR-5t4e: GACCTGACGACATAGACTTGAGAGAGCGACCGCCTGATGGAAGTTTCCATTAAACATAACCG SSR-5t16e: GACCTGACGACATAGACTTGAGAGAGCGACCTTTCATCCCCAAAAACAGGAAGACCGGAGAG SSR-5t18e: GACCTGACGACATAGACTTGAGAGAGCGACCAGCTGGCGGACGACGACAGTATCGTAGCCAG SSR-3t4f: GACCTGACGACATAGACTTGAGAGAGCGACATACGTAAAAGTACAACGGAGATTTCATCAAG SSR-3t18f: GACCTGACGACATAGACTTGAGAGAGCGACGAAGATCGGTGCGGGGCCTCTTCGCAATCATGG SSR-3t2e: GACCTGACGACATAGACTTGAGAGAGCGACCAATGACACTCCAAAAGGAGCCTTACAACGCC SSR-3t4e: GACCTGACGACATAGACTTGAGAGAGCGACGCGAAACATGCCACTACGAAGGCATGCGCCGA SSR-3t16e: GACCTGACGACATAGACTTGAGAGAGGAGCGACAAATAATTTTAAATTGTAAACGTTGATATTCA SSR-1t2f: GACCTGACGACATAGACTTGAGAGAGCGACTCGGTTTAGCTTGATACCGATAGTCCAACCTA SSR-1t4f: GACCTGACGACATAGACTTGAGAGAGAGCGACAAACGAAATGACCCCCAGCGATTATTCATTAC SSR-1t18f: GACCTGACGACATAGACTTGAGAGAGCGACGCTTCTGGTCAGGCTGCGCAACTGTGTTATCC SSR-1t4e: GACCTGACGACATAGACTTGAGAGAGCGACCTCATCTTGAGGCAAAAGAATACACTCCCTCA SSR-1t6e: GACCTGACGACATAGACTTGAGAGAGCGACGAATAAGGACGTAACAAAGCTGCTGACGGAAA SSR-1t8e: GACCTGACGACATAGACTTGAGAGAGCGACCATAACCCGAGGCATAGTAAGAGCTTTTTAAG SSR-1t10e: GACCTGACGACATAGACTTGAGAGAGCGACTTTTAATTGCCCGAAAGACTTCAATTCCAGAG SSR-1t12e: GACCTGACGACATAGACTTGAGAGAGCGACTTTCATTTGGTCAATAACCTGTTTAATCAATA SSR-1t14e: GACCTGACGACATAGACTTGAGAGAGCGACAGACAGTCATTCAAAAGGGTGAGATATCATAT SSR-1t16e: GACCTGACGACATAGACTTGAGAGAGCGACGCTCATTTTCGCATTAAATTTTTGAGCTTAGA SSR-1t18e: GACCTGACGACATAGACTTGAGAGAGCGACTTCGCCATTGCCGGAAACCAGGCAAACAGTAC SSR1t4f: GACCTGACGACATAGACTTGAGAGAGCGACGAGCGCCCCACCACCGGAACCGCCTAAAACA SSR1t8f: GACCTGACGACATAGACTTGAGAGAGCGACAAAAGTAATATCTTACCGAAGCCCAACACTAT SSR1t10f: GACCTGACGACATAGACTTGAGAGAGCGACCCTAATTTACGCTAACGAGCGTCTATATCGCG SSR1t12f: GACCTGACGACATAGACTTGAGAGAGCGACGACGTGGGGGGGAGCATGTAGAAACCAGCTATAT SSR1t14f: GACCTGACGACATAGACTTGAGAGAGGGGCGACGCGTTATAGAAAAAGCCTGTTTAGAAGGCCGG SSR1t16f: GACCTGACGACATAGACTTGAGAGAGCGACTTAAGACGTTGAAAACATAGCGATTTAAATCA SSR1t18f: GACCTGACGACATAGACTTGAGAGAGCGACCTTTTACACAGATGAATATACAGTAAGCGCCA SSR1t2e: GACCTGACGACATAGACTTGAGAGAGCGACTGCCTTGACTGCCTATTTCGGAACAGGGATAG SSR1t4e: GACCTGACGACATAGACTTGAGAGAGCGACAACCAGAGACCCTCAGAACCGCCAGGGGTCAG SSR1t16e: GACCTGACGACATAGACTTGAGAGAGCGACTAGAATCCCTGAGAAGAGTCAATAGGAATCAT SSR1t18e: GACCTGACGACATAGACTTGAGAGAGCGACTTTAACGTTCGGGAGAAACAATAATTTTCCCT SSR3t4f: GACCTGACGACATAGACTTGAGAGAGCGACGCCACCACTCTTTTCATAATCAAACCGTCACC SSR3t2e: GACCTGACGACATAGACTTGAGAGAGCGACAGTGTACTTGAAAGTATTAAGAGGCCGCCACC SSR3t4e: GACCTGACGACATAGACTTGAGAGAGCGACGTTTGCCACCTCAGAGCCGCCACCGATACAGG SSR3t16e: GACCTGACGACATAGACTTGAGAGAGCGACCTGTAAATCATAGGTCTGAGAGACGATAAATA

SSR3t18e: GACCTGACGACATAGACTTGAGAGAGAGCGACACAGAAATCTTTGAATACCAAGTTCCTTGCTT SSR5t4f: GACCTGACGACATAGACTTGAGAGAGCGACCACCAGAGTTCGGTCATAGCCCCCGCCAGCAA SSR5t18f: GACCTGACGACATAGACTTGAGAGAGGAGCGACGCGCAGAGATATCAAAATTATTTGACATTATCSSR5t2e: GACCTGACGACATAGACTTGAGAGAGCGACGACGAAGGATTAGGATTAGGACTAGCGCCA SSR5t4e: GACCTGACGACATAGACTTGAGAGAGCGACTCGGCATTCCGCCGCCAGCATTGACGTTCCAG SSR5t16e: GACCTGACGACATAGACTTGAGAGAGCGACAAATCAATGGCTTAGGTTGGGTTACTAAATTT SSR5t18e: GACCTGACGACATAGACTTGAGAGAGCGACAACCTACCGCGAATTATTCATTTCCAGTACAT SSR7t8f: GACCTGACGACATAGACTTGAGAGAGCGACTTATTACGGTCAGAGGGTAATTGAATAGCAGC SSR7t10f: GACCTGACGACATAGACTTGAGAGAGCGACCTTTACAGTTAGCGAACCTCCCGACGTAGGAA SSR7t12f: GACCTGACGACATAGACTTGAGAGAGCGACTCATTACCCGACAATAAACAACATATTTAGGC SSR7t14f: GACCTGACGACATAGACTTGAGAGAGGGGACAGAGGGCATAATTTCATCTTCTGACTATAACTA SSR7t16f: GACCTGACGACATAGACTTGAGAGAGCGACTATGTAAACCTTTTTTAATGGAAAAATTACCT SSR7t18f: GACCTGACGACATAGACTTGAGAGAGCGACGAGGAGAAAAACTTCTGAATAATGGAAGAAGGAG SSR7t4e: GACCTGACGACATAGACTTGAGAGAGCGACTGCCTTTAGTCAGACGATTGGCCTGCCAGAAT SSR7t6e: GACCTGACGACATAGACTTGAGAGAGCGACACGCAAAGGTCACCAATGAAACCAATCAAGTT SSR7t10e: GACCTGACGACATAGACTTGAGAGAGCGACGAGGCGTTAGAGAATAACATAAAAGAACACCC SSR7t14e: GACCTGACGACATAGACTTGAGAGAGCGACTTTTAGTTTTTCGAGCCAGTAATAAATTCTGT SSR7t16e: GACCTGACGACATAGACTTGAGAGAGCGACTTGAATATGCTGATGCAAAATCCACAAATATA Other sequences can be found in the sequences list for the rectangle origami⁴.

For the *eight-dot* pattern:

EDR-7t4e: AGAGTCTGACATGCTGCTCCATGAGAGGCTTTGAGGACTAGGGAGTT EDR-7t6e: AGAGTCTGACATGCTCGATTTTAGAGGACAGATGAACGGCGCGACCT EDR-5t6f: AGAGTCTGACATGCTCCAGGCGCTTAATCATTGTGAATTACAGGTAG EDR-7t16e: AGAGTCTGACATGCTACCCGTCGTCATATGTACCCCGGTAAAGGCTA EDR-7t18e: AGAGTCTGACATGCTATTAAGTTCGCATCGTAACCGTGCGAGTAACA $EDR\-5t18f: AGAGTCTGACATGCTGTTTGAGGGAAAGGGGGATGTGCTAGAGGATC$ EDR-1t4e: AGAGTCTGACATGCTCTCATCTTGAGGCAAAAGAATACACTCCCTCA EDR1t4f: AGAGTCTGACATGCTGAGCCGCCCCACCACCGGAACCGCCTAAAACA EDR-1t12e: AGAGTCTGACATGCTTTTCATTTGGTCAATAACCTGTTTAATCAATA EDR1t12f: AGAGTCTGACATGCTATCGGCTGCGAGCATGTAGAAACCAGCTATAT EDR-1t20e: AGAGTCTGACATGCTGCATAAAGTTCCACACAACATACGAAACAATT EDR1t20f: AGAGTCTGACATGCTCGACAACTAAGTATTAGACTTTACAGCCGGAA EDR7t4f: AGAGTCTGACATGCTTGAGGCAGGCGTCAGACTGTAGCGTAGCAAGG EDR7t12f: AGAGTCTGACATGCTTCATTACCCGACAATAAACAACATATTTAGGC EDR7t20f: AGAGTCTGACATGCTCGGAATTATTGAAAGGAATTGAGGTGAAAAAT Other sequences can be found in the sequences list for the rectangle origami⁴.

For seven-dot pattern:

SDR3t2e: AGACTCTAACCTGCAGTCACAACAGTACGCAGTGTACTTGAAAGTATTAAGAGGCCGCCACC SDR3t20f: AGACTCTAACCTGCAGTCACAACAGTACGCTTATTAATGCCGTCAATAGATAATCAGAGGTG SDR3t22f: AGACTCTAACCTGCAGTCACAACAGTACGCAGGCGGTCATTAGTCTTTAATGCGCAATATTA SDR3t20e: AGACTCTAACCTGCAGTCACAACAGTACGCAGGATTAGATTTAAAAGTTTGAGTACACGTAAA SDR5t10e: AGACTCTAACCTGCAGTCACAACAGTACGCAGGTTTTGAACGTCAAAAATGAAAGCGCTAAT SDR5t12e: AGACTCTAACCTGCAGTCACAACAGTACGCAGGTTTTGAACGTCAAAAATGAAAGCGCTAAT SDR5t12e: AGACTCTAACCTGCAGTCACAACAGTACGCAAGGCAGATTTGCAGCGTTTTTATTTTCATCTTGCGGGG SDR7t12f: AGACTCTAACCTGCAGTCACAACAGTACGCTCATTACCCGACAATAAACAACATATTTAGGC Other sequences can be found in the sequences list for the rectangle origami⁴.

For the *rectangular block* pattern:

The following sequences in the tall rectangular origami were removed: t1r12e, t1r14e, t1r16e, t1r18e, t1r20e, t1r12f, t1r14f, t1r16f, t1r18f, t1r20f, t-1r12e, t-1r14e, t-1r16e, t-1r18e, t-1r20e, t-1r12f, t-1r14f, t-1r16f, t-1r18f, t-1r20f.

Other sequences can be found in the sequences list for the tall rectangular origami⁴.

For the *three-dot* pattern:

The following sequences in the triangular origami were removed: A01, A05, A09, A13, A17, A33, A38, A42, A46, A50, B01, B05, B09, B13, B17, B33, B38, B42, B46, B50, C01, C05, C09, C13, C17, C33, C38, C42, C46, C50.

Other sequences can be found in the sequences list for the triangular origami⁴.

For the small digit 8 pattern:

mEt5r28e: GACCTGACGACATAGACTTGAGAGAGCGACGAAAATGGAAAACATCGCCATTAAACAGAGGTG mEt5r26e: GACCTGACGACATAGACTTGAGAGAGAGCGACAGGCGGTCTCTTTAGGAGCACTAAACATTTGA mEt5r22e: GACCTGACGACATAGACTTGAGAGAGCGACAACCTACCGCGAATTATTCATTTCACATCAAG mEt5r20e: GACCTGACGACATAGACTTGAGAGAGCGACAAAACAAACTGAGAAGAGTCAATATACCTTTT mEt5r28f: GACCTGACGACATAGACTTGAGAGAGCGACTAGCCCTATTATTTACATTGGCAGCAATATTA mEt5r26f: GACCTGACGACATAGACTTGAGAGAGCGACCTAAAATAAGTATTAACACCGCCTCGAACTGA mEt5r24f: GACCTGACGACATAGACTTGAGAGAGCGACGATGGCAAAAGTATTAGACTTTACAAGGTTAT mEt5r22f: GACCTGACGACATAGACTTGAGAGAGAGCGACGCGAGAGATATCAAAATTATTTGTATCAGAT mEt3r28e: GACCTGACGACATAGACTTGAGAGAGCGACGTCACACGATTAGTCTTTAATGCGGCAACAGT mEt3r20e: GACCTGACGACATAGACTTGAGAGAGCGACTTGAATTATTGAAAAACATAGCGATTATAACTA mEt3r28f: GACCTGACGACATAGACTTGAGAGAGCGACGAATGGCTACCAGTAATAAAAGGGCAAACTAT mEt3r20f: GACCTGACGACATAGACTTGAGAGAGCGACTAGAATCCCCTTTTTTAATGGAAACGGATTCG mEt1r28e: GACCTGACGACATAGACTTGAGAGAGCGACGCCAACAGATACGTGGCACAGACATGAAAAAT mEt1r28f: GACCTGACGACATAGACTTGAGAGAGCGACGCGTAAGAAGATAGAACCCTTCTGAACGCGCG mEt1r26f: GACCTGACGACATAGACTTGAGAGAGCGACAAACCCTCTCACCTTGCTGAACCTAGAGGATC mEt1r24f: GACCTGACGACATAGACTTGAGAGAGAGCGACATTTTGCGTTTAAAAGTTTGAGTACCGGCACC mEt1r22f: GACCTGACGACATAGACTTGAGAGAGCGACCTTTTACACAGATGAATATACAGTGCCATCAA mEt-1r26e: GACCTGACGACATAGACTTGAGAGAGCGACCCCGGGTACCTGCAGGTCGACTCTCAAATATC mEt-1r22e: GACCTGACGACATAGACTTGAGAGAGCGACAAATAATTTTTTAACCAATAGGAACAACAGTAC mEt-1r28f: GACCTGACGACATAGACTTGAGAGAGCGACGCCAGCTGCGGTTTGCGTATTGGGAATCAAAA mEt-1r20f: GACCTGACGACATAGACTTGAGAGAGCGACGGTAGCTATTGCCTGAGAGTCTGGTTAAATCA mEt-3r20e: GACCTGACGACATAGACTTGAGAGAGCGACAGAGAATCAGCTGATAAATTAATGCTTTATTT $mEt-3r28f;\ GACCTGACGACATAGACTTGAGAGAGCGACACTGCCCGCTTTTCACCAGTGAGATGGTGGTT$ mEt-3r20f: GACCTGACGACATAGACTTGAGAGAGCGACACCGTTCTGATGAACGGTAATCGTAATATTTT mEt-5r28e: GACCTGACGACATAGACTTGAGAGAGAGCGACAGCTGATTACTCACATTAATTGCGTGTTATCC mEt-5r26e: GACCTGACGACATAGACTTGAGAGAGAGCGACGCTCACAAGGGTAACGCCAGGGTTTTGGGAAG mEt-5r24e: GACCTGACGACATAGACTTGAGAGAGCGACGGCGATCGCGCATCGTAACCGTGCGAGTAACA

mEt-5r22e: GACCTGACGACATAGACTTGAGAGAGCGACACCCGTCGTTAAAATTGTAAACGTTAAAACTAG mEt-5r20e: GACCTGACGACATAGACTTGAGAGAGAGCGACCATGTCAAAAATCACCATCAATATAACCCTCA mEt-5r28f: GACCTGACGACATAGACTTGAGAGAGCGACGTGAGCTAGCCCTTCACCGCCTGGGGTTTGCC mEt-5r2ef: GACCTGACGACATAGACTTGAGAGAGCGACATTAAGTTTTCCACACAACATACGCCTAATGA mEt-5r2ef: GACCTGACGACATAGACTTGAGAGAGCGACCTAGATGGGGGTGCGGGGCCTCTTCGCGCAAGGCG mEt-5r2ef: GACCTGACGACATAGACTTGAGAGAGCGACCTAGATGGGGGTGCGGGGCCTCTTCGCGCAAGGCG mEt-5r2ef: GACCTGACGACATAGACTTGAGAGAGCGACGACAATATGATTCTCCCGTGGGAACCGTTGGTG mEt-5r20f: GACCTGACGACATAGACTTGAGAGAGCGACAGACAGTCTCATATGATCCCCGGTTTGTATAA Other sequences can be found in the sequences list for the tall rectangle origami⁴.

For the triangle origami patterns:

The sequence of 'AGACTAGACTAGACT' was used and linked to the 5 terminals of all the selected staple strands for the triangle DNA origami as shown in Fig. S28.

For the *C*, *u* patterns:

St5r8f: CTACCTCCTCACAATCCCGAGGAAACGCAATAATGAAATA St5r10f: CTACCTCCGCAATAGCAGAGAATAACATAAAAAACAGCCAT St5r12f: CTACCTCCATTATTTATTAGCGAACCTCCCGACGTAGGAA St5r14f: CTACCTCCTCATTACCGAACAAGAAAAATAATAATTCTGT St5r16f: CTACCTCCCCAGACGACAAATTCTTACCAGTAGATAAATA St5r18f: CTACCTCCAGGCGTTAGGCTTAGGTTGGGTTAAGCTTAGA St5r20f: CTACCTCCTTAAGACGATTAATTACATTTAACACAAAATC St5r22f: CTACCTCCGCGCAGAGATATCAAAATTATTTGTATCAGAT St5r24f: CTACCTCCGATGGCAAAAGTATTAGACTTTACAAGGTTAT St5r26f: CTACCTCCCTAAAATAAGTATTAACACCGCCTCGAACTGA St3r4e: CTACCTCCGTTTGCCACCTCAGAGCCGCCACCGCCAGAAT St3r6e: CTACCTCCTTATTCATGTCACCAATGAAACCATTATTAGC St3r8e: CTACCTCCATACCCAAACACCACGGAATAAGTGACGGAAA St3r10e: CTACCTCCGCGCATTAATAAGAGCAAGAAACAATAACGGA St3r12e: CTACCTCCAGGTTTTGGCCAGTTACAAAATAAACAGGGAA St3r14e: CTACCTCCCTAATTTACCGTTTTTATTTTCATCTTGCGGG St3r16e: CTACCTCCACGCTCAACGACAAAAGGTAAAGTATCCCATC St3r18e: CTACCTCCTATGTAAAGAAATACCGACCGTGTTAAAGCCA St3r20e: CTACCTCCTTGAATTATTGAAAACATAGCGATTATAACTA St3r22e: CTACCTCCACAGAAATCTTTGAATACCAAGTTAATTTCAT St3r24e: CTACCTCCCGACAACTTCATCATATTCCTGATCACGTAAA St3r26e: CTACCTCCGCCACGCTTTGAAAGGAATTGAGGAAACAATT St3r6f: CTACCTCCCCGGAAACTAAAGGTGAATTATCATAAAAGAA St3r26f: CTACCTCCATCAACAGGAGAGCCAGCAGCAAAATATTTTT Stlr4e: CTACCTCCAACCAGAGACCCTCAGAACCGCCACGTTCCAG St1r6e: CTACCTCCGACTTGAGGTAGCACCATTACCATATCACCGG St1r24e: CTACCTCCTTATTAATGAACAAAGAAACCACCTTTTCAGG St1r26e: CTACCTCCCTAAAGCAAATCAATATCTGGTCACCCGAACG St1r6f: CTACCTCCAATCACCACCATTTGGGAATTAGACCAACCTA St1r26f: CTACCTCCAAACCCTCTCACCTTGCTGAACCTAGAGGATC St-1r4e: CTACCTCCCAATGACAGCTTGATACCGATAGTCTCCCTCA St-1r6e: CTACCTCCAAACGAAATGCCACTACGAAGGCAGCCAGCAA St-1r24e: CTACCTCCGCTTCTGGCACTCCAGCCAGCTTTACATTATC St-1r26e: CTACCTCCCCGGGTACCTGCAGGTCGACTCTCAAATATC St-1r6f: CTACCTCCATACGTAAGAGGCAAAAGAATACACTGACCAA St-1r26f: CTACCTCCCTTGCATGCCGAGCTCGAATTCGTCCTGTCGT St-3r4e: CTACCTCCATATATTCTCAGCTTGCTTTCGAGTGGGATTT St-3r6e: CTACCTCCCTCATCTTGGAAGTTTCCATTAAACATAACCG St-3r24e: CTACCTCCTTCGCCATGGACGACGACAGTATCGTAGCCAG St-3r26e: CTACCTCCTCATAGCTTGTAAAACGACGGCCAAAGCGCCA St-3r6f: CTACCTCCTTTCATGATGACCCCCAGCGATTAAGGCGCAG St-3r8f: CTACCTCCACGGTCAATGACAAGAACCGGATATGGTTTAA

St-3r14f: CTACCTCCTCAGAAGCCTCCAACAGGTCAGGATTTAAATA St-3r16f: CTACCTCCTGCAACTAGGTCAATAACCTGTTTAGAATTAG St-3r18f: CTACCTCCCAAAATTAGGATAAAAATTTTTAGGATATTCA St-3r20f: CTACCTCCACCGTTCTGATGAACGGTAATCGTAATATTTT St-3r22f: CTACCTCCGTTAAAATAACATTAAATGTGAGCATCTGCCA St-3r24f: CTACCTCCGTTTGAGGTCAGGCTGCGCAACTGTTCCCAGT St-3r26f: CTACCTCCCACGACGTGTTTCCTGTGTGAAATTTGCGCTC St-5r6e: CTACCTCCGCGAAACAAGAGGCTTTGAGGACTAGGGAGTT St-5r8e: CTACCTCCCCAAATCATTACTTAGCCGGAACGTACCAAGC St-5r14e: CTACCTCCTACCTTTAAGGTCTTTACCCTGACAATCGTCA St-5r16e: CTACCTCCTTTCATTTCTGTAGCTCAACATGTTTAGAGAG St-5r18e: CTACCTCCTATATTTTCATACAGGCAAGGCAAAGCTATAT St-5r20e: CTACCTCCCATGTCAAAAATCACCATCAATATAACCCTCA St-5r22e: CTACCTCCACCCGTCGTTAAATTGTAAACGTTAAAACTAG St-5r24e: CTACCTCCGGCGATCGCGCATCGTAACCGTGCGAGTAACA St-5r26e: CTACCTCCGCTCACAAGGGTAACGCCAGGGTTTTGGGAAG Other sequences can be found in the sequences list for the tall rectangle origami⁴.

SCu GGAGGTAGGACAAGCACGATACCATGCGTCTTCGGTAG

For the A, g patterns:

Et5r6f: CTTGGGTCGTAGACATCGACGACTACTGACAGCACCGTAGGGAAGGTAAATATTTTATTTTG Et5r8f: CTTGGGTCGTAGACATCGACGACTACTGACTCACAATCCCGAGGAAACGCAATAATGAAATA Et5r10f:CTTGGGTCGTAGACATCGACGACTACTGACGCAATAGCAGAGAATAACATAAAAACAGCCAT Et5r12f: CTTGGGTCGTAGACATCGACGACTACTGACATTATTATTAGCGAACCTCCCGACGTAGGAA Et5rl4f: CTTGGGTCGTAGACATCGACGACTACTGACTCATTACCGAACAAGAAAAATAATAATTCTGT Et5r16f: CTTGGGTCGTAGACATCGACGACGACTACTGACCCAGACGACAAATTCTTACCAGTAGATAAATA Et5r18f: CTTGGGTCGTAGACATCGACGACTACTGACAGGCGTTAGGCTTAGGTTGGGTTAAGCTTAGA Et5r22f: CTTGGGTCGTAGACATCGACGACTACTGACGCGCAGAGATATCAAAATTATTTGTATCAGAT $Et5r24f:\ CTTGGGTCGTAGACATCGACGACTACTGACGATGGCAAAAGTATTAGACTTTACAAGGTTAT$ Et5r26f: CTTGGGTCGTAGACATCGACGACTACTGACCTAAAATAAGTATTAACACCGCCTCGAACTGA Et3r4e: CTTGGGTCGTAGACATCGACGACTACTGACGTTTGCCACCTCAGAGCCGCCACCGCCAGAAT Et3r6e: CTTGGGTCGTAGACATCGACGACTACTGACTTATTCATGTCACCAATGAAACCATTATTAGC Et3r8e: CTTGGGTCGTAGACATCGACGACTACTGACATACCCAAAACACCACGGAATAAGTGACGGAAA Et3r10e: CTTGGGTCGTAGACATCGACGACTACTGACGCGCATTAATAAGAGCAAGAAACAATAACGGA Et3r12e: CTTGGGTCGTAGACATCGACGACTACTGACAGGTTTTGGCCAGTTACAAAATAAACAGGGAA Et3r14e: CTTGGGTCGTAGACATCGACGACTACTGACCTAATTTACCGTTTTTATTTTCATCTTGCGGG Et3r16e: CTTGGGTCGTAGACATCGACGACTACTGACACGCTCAACGACAAAAGGTAAAGTATCCCATC Et3r20e: CTTGGGTCGTAGACATCGACGACTACTGACTTGAATTATTGAAAAACATAGCGATTATAACTA Et3r22e: CTTGGGTCGTAGACATCGACGACTACTGACACAGAAATCTTTGAATACCAAGTTAATTTCAT Et3r24e: CTTGGGTCGTAGACATCGACGACTACTGACCGACAACTTCATCATATTCCTGATCACGTAAA Et3r26e: CTTGGGTCGTAGACATCGACGACTACTGACGCCACGCTTTGAAAGGAATTGAGGAAACAATT Et3r6f: CTTGGGTCGTAGACATCGACGACTACTGACCCGGAAACTAAAGGTGAATTATCATAAAAGAA Et3r16f: CTTGGGTCGTAGACATCGACGACTACTGACTAAAGTACCAGTAGGGCTTAATTGCTAAATTT Et3r26f: CTTGGGTCGTAGACATCGACGACTACTGACATCAACAGGAGAGCCAGCAGCAAAATATTTTT Et1r4e: CTTGGGTCGTAGACATCGACGACTACTGACAACCAGAGACCCTCAGAACCGCCACGTTCCAG Et1r6e: CTTGGGTCGTAGACATCGACGACTACTGACGACTTGAGGTAGCACCATTACCATATCACCGG Et1r14e: CTTGGGTCGTAGACATCGACGACTACTGACATCGGCTGACCAAGTACCGCACTCTTAGTTGC Et1r24e: CTTGGGTCGTAGACATCGACGACTACTGACTTATTAATGAACAAAGAAACCACCTTTTCAGG Et1r26e: CTTGGGTCGTAGACATCGACGACTACTGACCTAAAGCAAATCAATATCTGGTCACCCGAACG Et1r6f: CTTGGGTCGTAGACATCGACGACTACTGACAATCACCACCATTTGGGAATTAGACCAACCTA Et1r16f: CTTGGGTCGTAGACATCGACGACTACTGACAGAGGCATACAACGCCAACATGTATCTGCGAA Et1r26f: CTTGGGTCGTAGACATCGACGACTACTGACAAACCCTCTCACCTTGCTGAACCTAGAGGATC Et-1r4e: CTTGGGTCGTAGACATCGACGACTACTGACCAATGACAGCTTGATACCGATAGTCTCCCTCA

Et-1r14e: CTTGGGTCGTAGACATCGACGACTACTGACTTTTAATTGCCCGAAAGACTTCAACAAGAACG Et-1r16e: CTTGGGTCGTAGACATCGACGACTACTGACCGAGTAGAACAGTTGATTCCCAATATTTAGGC Et-1r26e: CTTGGGTCGTAGACATCGACGACTACTGACCCCGGGTACCTGCAGGTCGACTCTCAAATATC Et-1r6f: CTTGGGTCGTAGACATCGACGACTACTGACATACGTAAGAGGCAAAAGAATACACTGACCAA Et-1r16f: CTTGGGTCGTAGACATCGACGACTACTGACTCCATATATTTAGTTTGACCATTAAGCATAAA Et-1r26f: CTTGGGTCGTAGACATCGACGACTACTGACCTTGCATGCCGAGCTCGAATTCGTCCTGTCGT Et-3r6e: CTTGGGTCGTAGACATCGACGACTACTGACCTCATCTTGGAAGTTTCCATTAAACATAACCG Et-3r14e: CTTGGGTCGTAGACATCGACGACTACTGACGAAGCAAAAAAGCGGATTGCATCAATGTTTAG Et-3r16e: CTTGGGTCGTAGACATCGACGACTACTGACTCGCAAATAAGTACGGTGTCTGGACCAGACCG Et-3r24e: CTTGGGTCGTAGACATCGACGACGACTACTGACTTCGCCATGGACGACGACGACAGTATCGTAGCCAG Et-3r26e: CTTGGGTCGTAGACATCGACGACTACTGACTCATAGCTTGTAAAACGACGGCCAAAGCGCCA Et-3r6f: CTTGGGTCGTAGACATCGACGACTACTGACTTTCATGATGACCCCCAGCGATTAAGGCGCAG Et-3r8f: CTTGGGTCGTAGACATCGACGACTACTGACACGGTCAATGACAAGAACCGGATATGGTTTAA Et-3r10f: CTTGGGTCGTAGACATCGACGACTACTGACTTTCAACTACGGAACAACATTATTAACACTAT Et-3r12f: CTTGGGTCGTAGACATCGACGACTACTGACCATAACCCGCGTCCAATACTGCGGTATTATAG Et-3r14f: CTTGGGTCGTAGACATCGACGACTACTGACTCAGAAGCCTCCAACAGGTCAGGATTTAAATA Et-3r16f: CTTGGGTCGTAGACATCGACGACTACTGACTGCAACTAGGTCAATAACCTGTTTAGAATTAG Et-3r18f: CTTGGGTCGTAGACATCGACGACTACTGACCAAAATTAGGATAAAAATTTTTAGGATATTCA Et-3r20f: CTTGGGTCGTAGACATCGACGACTACTGACACCGTTCTGATGAACGGTAATCGTAATATTTT Et-3r22f: CTTGGGTCGTAGACATCGACGACTACTGACGTTAAAATAACATTAAATGTGAGCATCTGCCA Et-3r24f: CTTGGGTCGTAGACATCGACGACTACTGACGTTTGAGGTCAGGCTGCGCAACTGTTCCCAGT Et-3r26f: CTTGGGTCGTAGACATCGACGACTACTGACCACGACGTGTTTCCTGTGTGAAATTTGCGCTC Et-5r6e: CTTGGGTCGTAGACATCGACGACTACTGACGCGAAACAAGAGGCTTTGAGGACTAGGGAGTT Et-5r8e: CTTGGGTCGTAGACATCGACGACTACTGACCCAAATCATTACTTAGCCGGAACGTACCAAGC Et-5r10e: CTTGGGTCGTAGACATCGACGACTACTGACAAAGATTCTAAATTGGGCTTGAGATTCATTAC Et-5r12e: CTTGGGTCGTAGACATCGACGACTACTGACTAAATATTGAGGCATAGTAAGAGCACAGGTAG Et-5r14e: CTTGGGTCGTAGACATCGACGACTACTGACTACCTTTAAGGTCTTTACCCTGACAATCGTCA Et-5r16e: CTTGGGTCGTAGACATCGACGACTACTGACTTTCATTTCTGTAGCTCAACATGTTTAGAGAG Et-5r18e: CTTGGGTCGTAGACATCGACGACTACTGACTATATTTTCATACAGGCAAAGCAAAGCTATAT Et-5r20e: CTTGGGTCGTAGACATCGACGACTACTGACCATGTCAAAAATCACCATCAATATAACCCTCA Et-5r22e: CTTGGGTCGTAGACATCGACGACTACTGACACCCGTCGTTAAATTGTAAACGTTAAAACTAG Et-5r24e: CTTGGGTCGTAGACATCGACGACTACTGACGGCGATCGCGCATCGTAACCGTGCGAGTAACA Et-5r26e: CTTGGGTCGTAGACATCGACGACTACTGACGCTCACAAGGGTAACGCCAGGGTTTTGGGAAG Other sequences can be found in the sequences list for the tall rectangle origami⁴.

Staple for assembly of the origami of C, u, A, g patterns

L-7r2i: CTGAAACAATAGGAACCCATGTACAGGGATAGCAAGCCCA L-7r6e: TGCCTTTAGACAGCATCGGAACGAACCCTCAG L-7r10e: AAAAGTAACTTGCCCTGACGAGAACATTCAGT L-7r14e: TATAGAAGCAGAAAACGAGAATGAAATGCTTT L-7r18e: AATTACTAACTAATAGTAGTAGCAAGGTGGCA L-7r22e: GAGCAAAAACCCAAAAACAGGAAGATGATAATC L-7r26e: AGATTAGAGAAAGGGGGGATGTGCTTATTACGC L-7r30e: GGAAATACGCAAGCGGTCCACGCTCCCTGAGA L7r2f: AATAATAAGTCAGACGATTGGCCTCAGGAGGT L7r6f: CGCCTGATAGACAAAAGGGCGACAGGTTTACC L7r10f: CATTCAACAACGTCAAAAATGAAAAAACGATT L7r14f: TTTTTGCGACGCGCCTGTTTATCAGTTCAGCT L7r18f: AGGTAAAG CATAGGTCTGAGAGACGTGAATTT L7r22f: GATTGACCACTTCTGAATAATGGATGATTGTT L7r26f: GCATAAAGCCAGCAGAAGATAAAAAATACCGA L7r30i: ACCCAAATCAGGAACGGTACGCCATTAAAGGGATTTTAGA L-7r4e: TGAGGCAGTTTTTTCACGTTGAAAGAATTGCG L-7r8e: AGCGCCAAAAATTGTGTCGAAATCTGTATCAT

L-7r12e: TTTTGTTTTAATGCAGATACATAAGAATACCA L-7r16e: AATGCAGAGATGGCTTAGAGCTTAAGAGGTCA L-7r20e: ATCAAAATATTCAAAAGGGTGAGATAATGTGT L-7r24e: TGGATTATGTAATGGGATAGGTCAAAACGGCG L-7r28e: ACGAACCATGTAAAGCCTGGGGTGAGCCGGAA L7r4f: CAGCGAAAGCGTCAGACTGTAGCGATCAAGTT L7r8f: GAATAAGGGCAGATAGCCGAACAATTTTTAAG L7r12f: AAACAGTTGCTTATCCGGTATTCTAAATCAGA L7r16f: TCAATTCTGAAAAAGCCTGTTTAGGGAATCAT L7r20f: AGAAAAGCGAAGATGATGAAACAAAATTACCT L7r24f: CAGCTGGCGCCGTCAATAGATAATCAACTAAT

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