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1. DNA design. The chiral DNA nanotube is assembled from 236 staples and an M13mp18 single-stranded template. 7057 nt of the 7249 nt template are used in the design, the remaining 192 nt is left as a single stranded loop at one end of the tube. A caDNAno schematic of the design is shown in Fig. S1. The ends of the tube can be modified by the addition of single-stranded T_8 tails to block polymerisation (Fig. S2a) or left unmodified to promote end-to-end interaction. Specific interactions formed by staple extensions can be used to join tubes in a precise register (Fig. S2b).

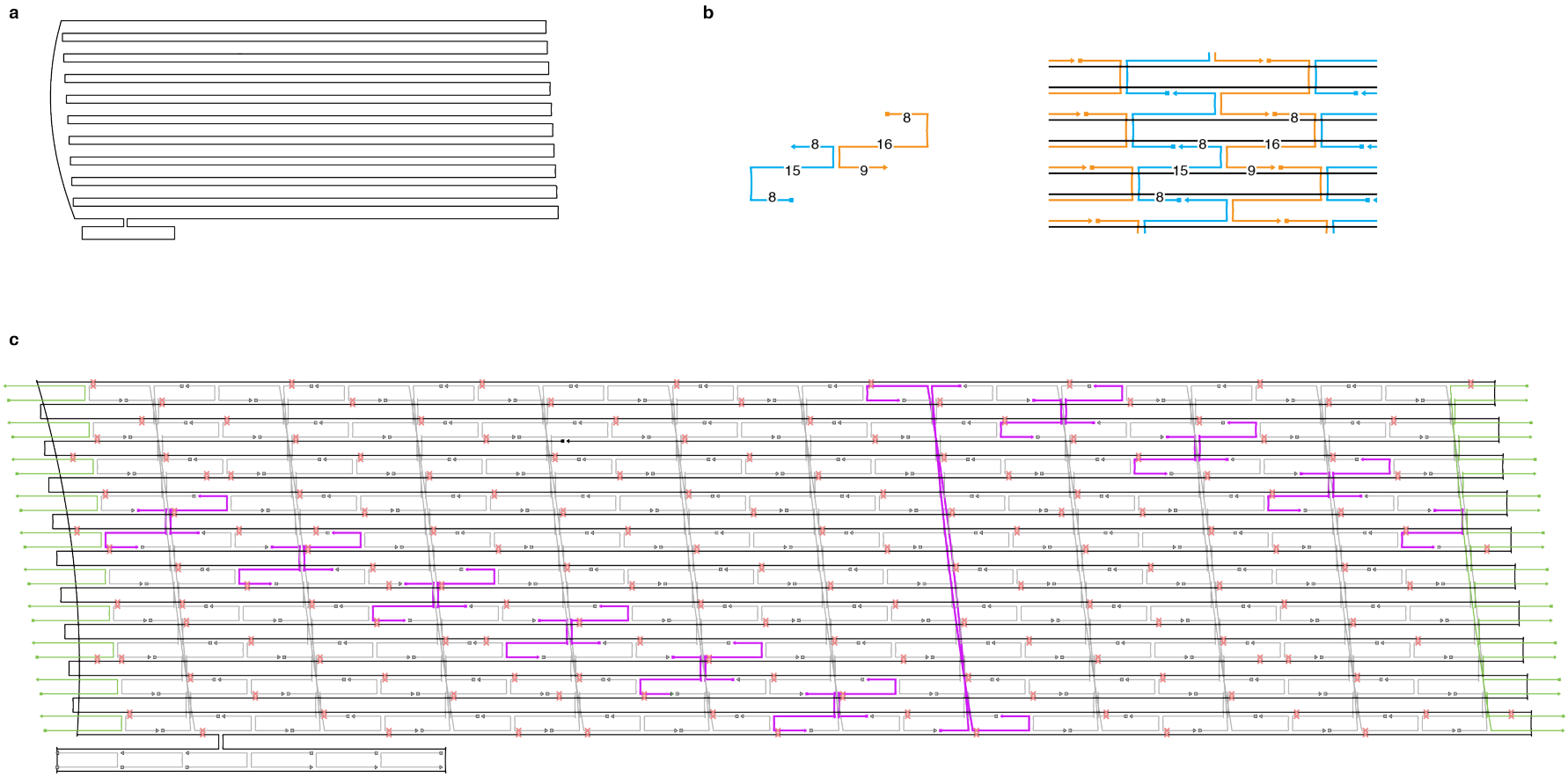

Fig S1. Tube design. a) The template connects 20 helices without a central seam. **b** Curvature is introduced by using two staple types with an 8-15-8 nt domain structure and an 8-16-9 nt domain structure (blue and orange respectively) **c**) The left and right-hand edges of the tube can be functionalized with staples that block or promote interaction between tubes (green). Staples marked in purple were modified to make a helical track on the inside surface of the tube for Fig. 4 of the accompanying manuscript. All 21 staples highlighted in orange are modified at with the motor track for tube 'A' the first 5 orange staples from the left-hand edge are modified with the motor track for tube 'B'.

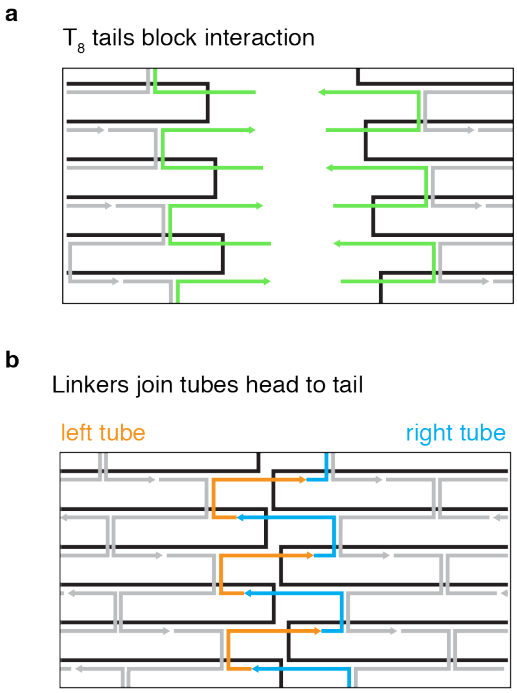

Fig S2. Linking strategies. a) Edge staples modified with T_8 tails (green) block non-specific stacking interactions between tubes. **b**) Two tube types (A and B, left and right) can be linked head to tail using short (6 nt) complementary sequences that extend from linker staples (orange and blue). Note that the unusual structure of the seam between left and right tubes is a consequence of the head-to-tail arrangement chosen for the motor track described below. Tubes joined head-to-head or tail-to-tail would have a conventional seam structure.

2. DNA sequences.

CORE STAPLES

For monomer and dimer tubes, add BLOCK or LINK STAPLES as required. For tubes with a track on the inside surface, replace purple staples with TRACK STAPLES as required. For gold nanoparticle attachment on the inside of the tube add A_{15} to the 3' end of staples marked with a superscript ‘a’. For gold nanoparticle attachment on the outside, replace staples marked with a superscript ‘a’ or ‘b’ with GOLD staples. Staples are named according to the location of the 5' and 3' ends as generated by caDNAno.

9[180] 11[180]	(S1)	TGCTTTCGCAAAAAAAAGGCTCCACAAATAAA
10[195] 8[195]	(S2)	AAAATCTCAGGTGAATTTCTTAGGCTTGAG
11[213] 13[213]	(S3)	TCTGAATTCACCACCAGAGCCGCCGGAAACCG
12[228] 10[228]	(S4)	ACCAGAACTACCGTTCCAGTAACAACTAAA
13[246] 15[246]	(S5)[b]	GAACTGGCAATATCAGAGAGATAATAAGTCCT
14[261] 12[261]	(S6)[a]	TGAGCGCTATGATTAAGACTCCAGAACCGC
15[279] 17[279]	(S7)	CGAGCATGAGCCAACGCTCAACAGAAGAAAACA
16[294] 14[294]	(S8)	CAGTATAATAGAAACCAATCAAAGAATTAA
17[312] 19[312]	(S9)	TACCTTTTTTGTTTGGATTATACTAGGTGAGG
18[327] 16[327]	(S10)	AATCCTGATTAATGGAAACAGTAAGCCTGT
19[345] 21[345]	(S11)	ACGCTGAGCAAACTATCGGCCTTGAGAAAGGA
20[360] 18[360]	(S12)	GAAGAACTAGCCAGCAGCAAATCATATTCC
21[378] 3[368]	(S13)[a]	CGCTGGCATTCCACACAACATACGGTGCCGGA
2[383] 20[393]	(S14)	GCTCACAAAGTGTAGCGGTCACATACTTCT
3[401] 5[401]	(S15)	TGCGCAACATTGCCTGAGAGTCTTAATACTTT
4[416] 2[416]	(S16)	ATCAGGTCTGTTGGGAAGGGCGAATCATGGT
5[434] 7[434]	(S17)	TAAAAATTGCAAAGCGGATTGCATTGCCAGAG
6[449] 4[449]	(S18)	AGTCAGAATTTAGAACCCTCATACCGGAGAG
7[467] 9[467]	(S19)	CGTCCAATGATAAATTGTGTCGATAAAACGAA
8[482] 6[482]	(S20)	CATCGCCTACTGCGGAATCGTCAACCATAAA
9[500] 11[500]	(S21)	TTTGACCCAGAACCGCCACCCTCTGTATCACC
5[338] 7[338][a]		TAAAGCCTCAAACTCCAACAGGTATTACGAGG
16[262] 14[262][a]		TAATTGAAAAATAATATCCCATAGGGTAAT
20[232] 18[232][a]		CATTGGCCTTTAATGCGCGAACAAAGAAAT
2[191] 20[201][a]		AGGGTGGTAGAGAGGGGCGATGCGACCAGT
17[184] 19[184][a]		GCTTTGAATAACAGTACCTTTTACAAGCGTAAG
20[424] 18[424][a]		CACGCAAATCAATATCTGGTCAAAGTTTGA
3[369] 5[369][a]		AACCAGGCTCGATGAACGGTAATCAATCGGTT
6[385] 4[385][a]		GCGTTTTAACATTATGACCCTGGGAGCAAA
8[322] 6[322][a]		ATCAAGAATAACGCCAAAAGGACAGGATTA
18[455] 16[455][a]		TGCCCGAAAGAAGAGTCAATAGAAACTTTT
12[292] 10[292][a]		CCTCCCTTTAACGGGGTCAGTGTTTCTGTA
2[415] 20[425][a]		CATAGCTCACCCGCCGCGCTTACTGTCCAT
20[456] 18[456][a]		AGTGAGGCTGAAAGGAATTGAGAAATCCTT
18[231] 16[231][a]		TGCGTAGAATTCATTTCAATTACAACGCCA
16[486] 14[486][a]		AATCGCAACGAACCTCCCGACTAATTTTAT
19[185] 21[185][a]		AATACGTGGGACATTCTGGCCAATTCACCGCC
14[293] 12[293][a]		CTGAACACAGCAAACGTAGAAAACGGAACCG
15[215] 17[215][a]		CGCGCCTGTTTAGGCAGAGGCATTCGCGCAGA
11[501] 13[501][a]		GTACTCAGCACCAGTAGCACCATTCACCGACT
17[408] 19[408][a]		ATCCTTGAATCATTTTGCGGAACAAAATATCA
10[323] 8[323][a]		TTTCCAGATCGTCACCCTCAGCATGACCTTC
11[245] 13[245][a]		ATGGCTTTGAGCCACCACCCTCAACCCAAAA
9[308] 11[308][a]		TTGCGGGACGTTAGTAAATGAATCCTTGAGTA
15[471] 17[471][a]		CGTTTTAGGACAAAGAACGCGAGATGAATTTA
13[502] 15[502][a]		TGAGCCATTTTTGCACCCAGCTACTGCGGGAGG
7[211] 9[211]		AAAATCTAAACGAGTAGTAAATTGAACAGCTTG
5[370] 7[370][b]		GTACCAAAAATTCGAGCTTCAAAGTAACCCTCG
8[354] 6[354]		TACAGACCGAGCAACACTATCACGAACCAG
14[197] 12[197]		AACAATGACAAAGTTACCAGAAGCCAGCAT
23[192] 22[192]		AAATCCCTTATAAATCTCTATCATTGCAGCAA
3[241] 5[241]		TAGGTCACAAAATTCGCATTAAATTTGGGGCGC
3[209] 5[209]		GGGAACAACATTTTTTAACCAATTGGTCAATA
3[497] 5[497]		AACGCCAGAATCACCATCAATATGGTAAAGAT
21[314] 3[304]		GGGGAAAGTAACTCACATTAATTGGGGACGACG
5[498] 7[498]		TCAAAAGGTCAGAAAACGAGAATGTAAATATT
19[249] 21[249]		TAAAACATCAATCGTCTGAAATGGTTTTTGGG
4[448] 2[448]		GGTAGCTCGCTATTACGCCAGCGAGGATCC
10[387] 8[387]		AACGCCTGAGGACTAAAGACTTCCGAACTG
6[481] 4[481]		TCAAAAACCTGAGTAATGTGTAGATATTCA
18[359] 16[359]		TGATTATCTGAGTGAATAACCTTGAATAAAC
12[196] 10[196]		TGACAGGAAAGCCAGAATGGAATCACGTTG
5[466] 7[466]		ATGCAATGTCAGGTCTTTACCCTGACTGGATAG
2[447] 20[457]		CCGGGTACCGCGTACTATGGTTGTTATAATC
10[259] 8[259]		AGCGGAGCACGCATAACCGATAAAGCTGCT
22[223] 23[223]		AAAGGGCGAAAAACCGAAAAGAATAGCCCGAG
19[313] 21[313]		CGGTCAGTACAATATTACCGCCAGGAGCTTGAC
20[488] 18[488]		CGCCAGAATCTTTAGGAGCACTAAGACTTTA
7[371] 9[371]		TTTACCAGTGAAAGAGGACAGATCGGCTACAG
6[225] 4[225]		TTAAATATAGCTATATTTTCATTTTTGTTA
19[409] 21[409][b]		AACCCTCAATTAACCGTTGTAGCAGCTGCGCGT

7[179] 9[179] CTCATTATATTTCAACTTTAATCTTATCAGCT
20[200] 18[200]b AATAAAAGGCACAGACAATATTTCAGATGAA
4[192] 2[192] CATCAAAATAACAACCCGTCGGTGGGCGCC
18[295] 16[295] ATGGAAGTACATTTAACAATTTATTCTTAC
11[309] 13[309]b ACAGTGCCGAACCAGAGCCACCACTACATACA
2[479] 20[489] TGCATGCCAACGTGCTTTCCTCGAACGGTA
3[337] 5[337] GCCAGCTTCAATCATATGTACCCCATTAAGCAA
3[305] 5[305] ACAGTATCAGCCCCAAAAACAGGAATCATACA
14[485] 12[485]b CCTGAATCGTGAATTATCACCGTACCATTAG
15[343] 17[343] AAACCAAGTCATAATTACTAGAAAACATAAATC
21[474] 3[464] GCACGTATTGCAGGTCGACTCTATGGCGAAAG
19[217] 21[217] CTATTAGTAGATTCACCAGTCACAGCCCACTAC
23[160] 22[160] AATCCTGTTTGATGGTTGCCCCAGCAGGCGAA
6[257] 4[257] TGCTGAATAAGGTGGCATCAATTCGTTAATA
3[273] 5[273] ACCGTGCAATATTTAAATTGTAAACTACTAAT
4[320] 2[320] ATCAGAAAGGCCTCAGGAAGATCGCCTAATG
9[436] 11[436] ATGCCACTGCCCAATAGGAACCCATTGCTCAGT
21[250] 3[240] GTCGAGGTCTGCATTAATGAATCGTAATGGGA
21[186] 3[176]b TGGCCCTGTTTTCTTTTCACCAGCATTAAATG
9[244] 11[244] CCATCGCCTGAGAATAGAAAGGAAGCGTCATAC
10[291] 8[291]b TGGGATTTTTGCAGGGAGTTAACCGGATAT
21[442] 3[432] CTACAGGGCGAGCTCGAATTCGTATCGGTGCG
18[199] 16[199] TATACAGTACCAAGTTACAAAATTTCGAGC
13[438] 15[438] GGAGGGAACTAATTTGCCAGTTACCAGATATA
8[418] 6[418] GCAGACGTTTGCAAAAGAAGTTTCAAAAAG
17[280] 19[280] AAATTAATGGTTAGAACCTACCACCGAACGAA
6[193] 4[193] GTTTCATGATACATTTCGCAAAAGGAACGC
18[263] 16[263] TTATTTGCGATGAAACAAACATCTAGGGCT
9[212] 11[212] ATACCGATCGAATAATAATTTTTAGCGCAGTC
11[437] 13[437] ACCAGGCGCACCGTAATCAGTAGCCGATTGAG
12[452] 10[452] GATAGCAGGATAAGTGCCGTCGATTTCAGGG
18[391] 16[391] ACCAGAAGCTATTAATTAATTTACCGACCG
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5[274] 7[274] AGTAGTAGTTTGCGGATGGCTTAGATTCATCAG
19[441] 21[441] TCAACAGTCACCGAGTAAAAGAGTATGCGCCG
9[468] 11[468] AGAGGCAAGAGCCACCACCCTCATGAGGGTTG
12[324] 10[324] AATCACCGCGTATAAACAGTTATTGTCGTC
9[372] 11[372] AGGCTTTGTAGCATTCCACAGACATGAAACAT
6[289] 4[289] GGTCATTCATTAACATCCAATAAAGATTGT
2[287] 20[297] TCACTGCCGAGCCCCCGATTTACCATTGCA
23[176] 22[176] GGTTCCGAAATCGGCAGCGGTCCACGCTGGTT
13[374] 15[374] CAATAGAATTTTGTTTAACGTCAGAACAAGCA
2[255] 20[265] CGTGCCAGGCCGTAAAGCACTAACCTACATT
19[377] 21[377] AAAGCATCTAATAACATCACTTGGCGCTAGGG
7[243] 9[243] CAACATTAGAATAAGGCTTGCCCTGACAACAA
14[325] 12[325] AACAGGGGCAACATATAAAAGAATAATCAA
19[281] 21[281] CCACCAGAACGCTCATGGAAATAATCGGAAC
17[376] 19[376] AAATCGTCGGAGCGGAATTATCATGAAAAATCT
16[390] 14[390] TGTGATAATTATTTTCATCGTACAAATAAG
15[183] 17[183] ACAATAAAAGAGAATATAAAGTACGCCTGATT
9[404] 11[404] GAAGTTTGTTTCGTCACCAGTACCTCAAGAG
2[319] 20[329] AGTGAGCCCGGCGAACGTGGCGCTGGTAAT
13[214] 15[214] AGGAAACGTTAAGCCCAATAATAAAATGCAGAA
22[255] 23[255] GTCCACTATTAAAGAATTCCAGTTTGGAACAA
16[422] 14[422] ACCTAAATCAATAGCAAGCAAATAAAATAAA
17[248] 19[248] AAGAAGATACGTAAAACAGAAATTGATAGCCC
13[470] 15[470] CATTAAAGTTACCAACGCTAACGAACGCGAGG
6[321] 4[321]b GAGAGTACAAAGAATTAGCAAAGGTTGATA
18[487] 16[487] CAAACAAATAGGTCTGAGAGACGCAAATCC
4[256] 2[256] TTTTGTTGTTGGTGTAGATGGGAAACCTGT
13[310] 15[310] TAAAGGTGAAGCGCATTAGACGGGTAATCGGCT
7[275] 9[275] TTGAGATTCAAATCAACGTAACATATTCGGTC
5[242] 7[242] GAGCTGAAATAATGCTGTAGCTCCTAACGGAA
16[358] 14[358] ACCGGAATACCGCACTCATCGAAAAATGAA
6[353] 4[353] ACCGGAAGCAGAGCATAAAGCTAGTAAAACT
4[288] 2[288] ATAAGCAATCTGCCAGTTTGAGCGTTGCGC
15[311] 17[311] GTCTTTCCATATGCGTTATACAACATTTGAAT
14[421] 12[421] CAGCCATAAGGGCGACATTCAACGACAGAA
14[453] 12[453] TCCAGAGCGGTAAATATTGACGAAACCATC
3[433] 5[433] GGCCTCTTATTTTTGAGAGATCTAACGCAAGGA
2[223] 20[233] GCGGGGATCACCCAAATCAAGTATTATTTA
5[210] 7[210] ACCTGTTTGCAACTAAAGTACGGTTGGGAAGA
11[469] 13[469] ATATAAGTGGAAACGTCACCAATGGAAATTATT
20[328] 18[328] ATCCAGAATTAACACCGCCTGCATCAATAT
10[355] 8[355] AGTTAGCGAACGAGGGTAGCAAGAACGGTG
12[356] 10[356] TTATTAGCCGGAACCTATTATTCGCCCTCAT
6[417] 4[417] ATTAAGAGAAGCCTTTATTTCACAAAGGCT
11[181] 13[181] TCCTCATTAGGTTGAGGCAGGTCAAGTAAGCAG
3[465] 5[465] GGGGATGTAGCTGATAAATTAATGTATTTTAA
17[472] 19[472]b TCAAAATCTTCGACAACTCGTATTGAAGGTTAT
16[198] 14[198] CAGTAATACAACATGTTCAGCTGAGCAAGA
4[384] 2[384]b CAAGAGAAAAAGCGCCATTCGCTGTTATCC
10[227] 8[227] GGAATTGAGTTGCGCCGACAATGACGAGAA
20[296] 18[296] ACAGGAAACAGAAGATAAAACAGTCTGAATA
21[282] 3[272] CCTAAAGGCGCTTTCCAGTCGGGCGCATCGTA
7[307] 9[307] GCAGATACGTAATCTTGACAAGAAAGGCCGCTT
8[194] 6[194] ATGGTTTAACCAGTCAGGACGTGTCTGGAA
5[178] 7[178] GACCATTATCCATATAACAGTTGAAAGAACTGG
7[339] 9[339]b CATAGTAAAGGCGCATAGGCTGGCGCGAAAGA
4[352] 2[352] AGCATGTTCCGGCACCGCTTCTGAGCCGGA

11[341] 13[341]	GCCTATTTGTTTGCCATCTTTTCAACGCAAAG
14[389] 12[389]	AAACGATTAATTCATATGGTTTATGTAGCGC
5[306] 7[306]	GGCAAGGCCTTTAATTGCTCCTTTCAACTAAT
21[506] 3[496]	AGAGCGGGTAAAACGACGGCCAGTAAGTTGGGT
17[216] 19[216]^{b}	GGCGAATTTTTTCAGGTTTAACGTTTGAATGG
12[388] 10[388]	GTTTTCATAAGAGGCTGAGACTCAAACTAC
8[258] 6[258]	CATTCAGTTTACAGGTAGAAAGAGCTTAAT
4[224] 2[224]	AATCAGCTACGGCGGATTGACCGGCCAACGC
11[277] 13[277]	AATAAGTTCAGAGCCGCCACCCTCTTATTACGC
20[392] 18[392]	TTGATTAGACCTTGCTGAACCTCAAGAAACC
13[406] 15[406]	AAAGACAAATTATTTATCCCAATCGGAATCATT
16[326] 14[326]	TTAGTATCTTATCATTCCAAGAAAACATAAA
22[239] 23[239]	CGTGGACTCCAACGTCATAGGGTTGAGTGTTG
17[504] 19[504]	AACCTCCGAGGATTTAGAAGTATTACAACTAAT
13[342] 15[342]	ACACCACGCCTTTACAGAGAGAATCGGGTATT
4[480] 2[480]	ACCGTTCTGCTGCAAGGCGATTGCCAAGCT
10[419] 8[419]	AACACTGACCATTAAACGGGTAAAACGAGGC
16[230] 14[230]^{b}	ACATGTAATTTATCAACAATAGACCCACAAG
15[503] 17[503]^{b}	TTTTGAAGTATGTAAATGCTGATTACCTTTTT
18[423] 16[423]^{b}	GTAACATTAAACATAGCGATAGATCTTCTG
12[484] 10[484]	CAAGGCCATAGCCCGGAATAGGAGAACCGC
12[260] 10[260]^{b}	CACCCTCATGATGATACAGGAGTACAGTTTC
2[351] 20[361]	AGCATAAAAAGCGAAAGGAGCGGCCTGAGTA
9[276] 11[276]	GCTGAGGCTGCTAAACAACTTTCAGTACTGGT
7[403] 9[403]	GAGAGGCTGTCAATCATAAGGGAATTTCATGAG
15[247] 17[247]	GAACAAGAGAATCGCCATATTTAACCTGAGCAA
12[420] 10[420]	TCAAGTTTGGATTAGCGGGGTTTGTACCGT
15[375] 17[375]	AGCCGTTTATAAGGCGTTAAATAAGCTTCTGT
11[373] 13[373]	GAAAGTATTCGGCATTTTCGGTCATGTCACAAT
19[473] 21[473]	CTAAAATATCCTGAGAAGTGTTTCTTTGACGA
7[499] 9[499]	CATTGAATACAAAGTACAACGGAGACACTCATC
17[344] 19[344]	AATATATGAGATGATGGCAATTCAACAGTGCC
16[454] 14[454]^{b}	TCAAATAATCCGGTATTCTAAGAGCGTCTT
10[483] 8[483]	CACCCTCAAAGAATACACTAAAATTTGTAT
15[407] 17[407]	ACCGCGCCTTAATGGTTTGAAATTCCCTTAGA
15[439] 17[439]	GAAGGCTTTATTTTAGTTAATTTCCTTAGATTA
11[405] 13[405]	AAGGATTAGCCTTTAGCGTCAGACCCAGCGCC
17[440] 19[440]	AGACGCTGCGTTATTAATTTTAAGTTGGCAAA
14[229] 12[229]	AATTGAGCAATAATAACGGAATGAGCCGCC
13[182] 15[182]	ATAGCCGAAAATAGCAATAGCTACAGACGACG
8[226] 6[226]	ACACCAGCGTTAATAAAACGAAAACATGTT
10[451] 8[451]	ATAGCAAACGAAGGCACCAACCAATCCGCG
5[402] 7[402]	TGCGGGAGGAAGCCCGAAAGACTTAAAATAGC
14[357] 12[357]	AATAGCAGGAATAAGTTTATTTTAGCCCCC
21[346] 3[336]	AGGGAAGAGTGTAAAGCCTGGGGTGCACTCCA
9[340] 11[340]	CAGCATCGGTAACGATCTAAAGTTATGCCCCCT
19[505] 21[505]	AGATTAGAAGGGATTTTAGACAGGTTAGAATC
3[177] 5[177]	TGAGCGAGATAATTCGCGTCTGGTTTAGTTT
8[450] 6[450]	ACCTGCTCAGTAAAATGTTTAGACTATTAT
8[386] 6[386]	ACCAACTTACGACGATAAAAACCCAAATATC
7[435] 9[435]	GGGGTAATCATGTTACTTAGCCGGAATACGTA
13[278] 15[278]	AGTATGTTCCTGAACAAAGTCAGCCTAATTTA
21[410] 3[400]	AACCACCAGTTTCCTGTGTGAAATCATTCAGGC
8[290] 6[290]	TCATTACCTAGGAATACCACATTTGATAAGA
21[218] 3[208]	GTGAACCAGAGGCGGTTTGCGTATATTCTCCGT

BLOCK staples that block non-specific interaction between tubes

RIGHT-HAND EDGE	
2[523] 21[532]	TTTTTTTTTCACGACGTTGAGCTAAACAGGTTTTTTTT
4[524] 3[523]	TTTTTTTTCGGAGACAGTCAGGTTTTCCCAGTTTTTTTT
6[525] 5[524]	TTTTTTTTGCTTTAAACAGTGTGAGAAAGGCTTTTTTTT
8[526] 7[525]	TTTTTTTTACCAAGCGCGAACCCCCTCAAATTTTTTTTT
10[527] 9[526]	TTTTTTTTACCGCCACCCTCCCAGCGATTATTTTTTTTT
12[528] 11[527]	TTTTTTTTAGCCAGCAAAATGAGGTTTAGTTTTTTTTT
14[529] 13[528]	TTTTTTTTGATTAGTTGCTATTGGGAATTAGTTTTTTTT
16[530] 15[529]	TTTTTTTTGTTATATAACTACCTTAAATCAATTTTTTTT
18[531] 17[530]	TTTTTTTTATAATACATTTGGCTTAGGTTGGTTTTTTTT
20[532] 19[531]	TTTTTTTTAGGCCGATTAAGCCGTCAATAGTTTTTTTT
	TTTTTTTTAGCTTTCATCAATGAGACGGGCAACTTTTTTTT
LEFT-HAND EDGE	TTTTTTTTCGAACGAGTAGACCTTCCTGTAGCCTTTTTTTT
3[148] 2[147]	TTTTTTTTTTATGCGATTTTTTCCCAATTCTGTTTTTTTT
5[149] 4[148]	TTTTTTTTAATTGTATCGGTATTGTGAATTACCTTTTTTTT
7[150] 6[149]	TTTTTTTTGATATTCACAAAAAAGGAGCCTTTTTTTTTT
9[151] 8[150]	TTTTTTTTCTTTTTAAGAAAGACGATTGGCCTTTTTTTTT
11[152] 10[151]	TTTTTTTTAGTAATTCTGTCTCTTACCGAAGCCTTTTTTTT
13[153] 12[152]	TTTTTTTTATAACGGATTCCGACAAAAGGTAATTTTTTTT
15[154] 14[153]	TTTTTTTTCTTCTGACCTGAATCGGGAGAAACATTTTTTTT
17[155] 16[154]	TTTTTTTTAGCTGATTGCCCCAGAGATAGAACCTTTTTTTT
19[156] 18[155]	
21[157] 20[156]	

LINK STAPLES that link tubes A and B together (omit corresponding BLOCK staples).

Tube A 2[523]-21[532]	CGTTGAGCTAAACAGGAGCTGA
Tube A 4[524]-3[523]	CAGTCAGGTTTTCCCAGAGCTTT
Tube A 6[525]-5[524]	AACAGTGTGAGAAAGGCCGAACG
Tube A 8[526]-7[525]	CGCGAACCCCCTCAAATTTATGC
Tube A 10[527]-9[526]	ACCCTCCCAGCGATTATAATTGT

Tube A 12[528]-11[527]	CAAAATGAGGTTTAGTGATATT
Tube A 14[529]-13[528]	TTGCTATTGGGAATTAGCTTTTT
Tube A 16[530]-15[529]	TAACTACCTTAAATCAAAGTAAT
Tube A 18[531]-17[530]	CATTTGGCTTAGGTTGGATAACG
Tube A 20[532]-19[531]	ATTAAGCCGTCAATAGCTTCTG
Tube B 3[148]-2[147]	CATCAATGAGACGGGCAACTCACGA
Tube B 5[149]-4[148]	AGTAGACCTTCCTGTAGCCCGGAGA
Tube B 7[150]-6[149]	GATTTTTTCCCAATTCTGGCTTTA
Tube B 9[151]-8[150]	ATCGGTATTGTGAATTACCACCAAG
Tube B 11[152]-10[151]	CACAAAAAAGGAGCCTTTACCGCC
Tube B 13[153]-12[152]	AAGAAAGACGATTGGCCTTAGCCAG
Tube B 15[154]-14[153]	TCTGTCTCTTACCGAAGCCGATTAG
Tube B 17[155]-16[154]	GATTCCGACAAAAGGTAAGTTATA
Tube B 19[156]-18[155]	ACCTGAATCGGGAGAAACAATAATA
Tube B 21[157]-20[156]	TTGCCCCAGAGATAGAACCAGGCCG

GOLD STAPLES (outside surface)

GOLD 1	CCTGTTTTCTTTTCACCAGCATTAAATG
GOLD 2	CGTGGGACATTCTGGCCAATTCACCGCCTGGCAAAAAAAAAAAAAAA
GOLD 3	GCTTTGAATAACAGTACCTTTTACAAGCGTAAGAATAAAAAAAAAAAAAAAA
GOLD 4	AAAGGCACAGACAATATTTCAGATGAA
GOLD 5	AGGGTGGTAGAGAGGGGCGATGCGACCAGTAATAAAAAAAAAAAAAAAA
GOLD 6	AATTTTTTCAGGTTTAACGTTTGAATGG
GOLD 7	CGCGCCTGTTTAGGCAGAGGCATTCGCGCAGAGGCGAAAAAAAAAAAAAAA
GOLD 8	CATTGGCCTTTAATGCGCGAACAAAGAAATTGCGAAAAAAAAAAAAAAA
GOLD 9	GTAATTTATCAACAATAGACCCACAAG
GOLD 10	TAGAATTCATTTCAATTACAACGCCAACATAAAAAAAAAAAAAAA
GOLD 11	TGGCAATATCAGAGAGATAATAAGTCCT
GOLD 12	ATGGCTTTGAGCCACCACCCTCAACCCAAAAGAACAAAAAAAAAAAAAAA
GOLD 13	TAATTGAAAAATAATATCCCATAGGGTAATTGAGAAAAAAAAAAAAAAA
GOLD 14	CTCATGATGATACAGGAGTACAGTTTC
GOLD 15	CGCTATGATTAAGACTCCAGAACCGCCACCAAAAAAAAAAAAAAA
GOLD 16	CTGAACACAGCAAACGTAGAAAACGGAACCGCCTCAAAAAAAAAAAAAAA
GOLD 17	ATTTTTGCAGGGAGTTAACCGGATAT
GOLD 18	CCTTTAACGGGGTCAGTGTTTCTGTATGGGAAAAAAAAAAAAAAA
GOLD 19	TGCCGAACCAGAGCCACCACTACATACA
GOLD 20	TTGCGGGACGTTAGTAAATGAATCCTTGAGTAACAGAAAAAAAAAAAAAAA
GOLD 21	TTTCCAGATCGTCACCCTCAGCATGACCTTCATCAAAAAAAAAAAAAAA
GOLD 22	GTACAAAGAATTAGCAAAGGTTGATA
GOLD 23	AGAATAACGCCAAAAGGACAGGATTAGAGAAAAAAAAAAAAAAA
GOLD 24	GTAAAGGCGCATAGGCTGGCGCGAAAGA
GOLD 25	TAAAGCCTCAAACTCCAACAGGTATTACGAGGCATAAAAAAAAAAAAAAAA
GOLD 26	CAAAAATTCGAGCTTCAAAGTAACCCTCG
GOLD 27	AGGCTCGATGAACGGTAATCAATCGGTTGTACAAAAAAAAAAAAAAA
GOLD 28	CGCTGGCATTCCACACAACATACGGTGCCGGAAACCAAAAAAAAAAAAAAA
GOLD 29	AGAAAAAGCGCCATTCGCTGTTATCC
GOLD 30	GCGTTTTAACATTATGACCCTGGGAGCAAACAAGAAAAAAAAAAAAAAA
GOLD 31	CTCAATTAACCGTTGTAGCAGCTGCGCGT
GOLD 32	ATCCTTGAATCATTTTGCGGAACAAAATATCAAACCAAAAAAAAAAAAAAA
GOLD 33	CATAGCTCACCCGCCGCGCTTACTGTCCATCACGAAAAAAAAAAAAAAA
GOLD 34	CATTAAACATAGCGATAGATCTTCTG
GOLD 35	CAAATCAATATCTGGTCAAAGTTTGAGTAAAAAAAAAAAAAAAA
GOLD 36	AGTGAGGCTGAAAGGAATTGAGAAATCCTTTGCCAAAAAAAAAAAAAAA
GOLD 37	ATAATCCGGTATTCTAAGAGCGTCTT
GOLD 38	CGAAAGAAGAGTCAATAGAAACTTTTTCAAAAAAAAAAAAAAAA
GOLD 39	AATCTTCGACAACTCGTATTGAAGGTTAT
GOLD 40	CGTTTTAGGACAAAGAACGCGAGATGAATTTATCAAAAAAAAAAAAAAAA
GOLD 41	AATCGTGAATTATCACCGTACCATTAG
GOLD 42	AATCGCAACGAACCTCCCGACTAATTTTATCCTGAAAAAAAAAAAAAAA
GOLD 43	GAAGTATGTAAATGCTGATTACCTTTTT
GOLD 44	CCATTTTTGCACCCAGCTACTGCGGGAGGAAAAAAAAAAAAAAA
GOLD 45	GTACTCAGCACCAGTAGCACCATTCACCGACTTGAGAAAAAAAAAAAAAAA

GOLD IN STAPLES (inside surface)

GOLD IN 1	AATACGTGGGACATTCTGGCCAATTCACCGCCAAAAAAAAAAAAAAA
GOLD IN 2	GCTTTGAATAACAGTACCTTTTACAAGCGTAAGAAAAAAAAAAAAAAA
GOLD IN 3	AGGGTGGTAGAGAGGGGCGATGCGACCAGAAAAAAAAAAAAAAA
GOLD IN 4	CGCGCCTGTTTAGGCAGAGGCATTCGCGCAGAAAAAAAAAAAAAAAA
GOLD IN 5	CATTGGCCTTTAATGCGCGAACAAAGAAAAAAAAAAAAAAAA
GOLD IN 6	TGCGTAGAATTCATTTCAATTACAACGCCAAAAAAAAAAAAAAA
GOLD IN 7	ATGGCTTTGAGCCACCACCCTCAACCCAAAAAAAAAAAAAAAAA
GOLD IN 8	TAATTGAAAAATAATATCCCATAGGGTAAAAAAAAAAAAAAAA
GOLD IN 9	TGAGCGCTATGATTAAGACTCCAGAACCGCAAAAAAAAAAAAAAA
GOLD IN 10	CTGAACACAGCAAACGTAGAAAACGGAACCGAAAAAAAAAAAAAAA
GOLD IN 11	CCTCCCTTTAACGGGGTCAGTGTTTCTGTAAAAAAAAAAAAAAA
GOLD IN 12	TTGCGGGACGTTAGTAAATGAATCCTTGAGTAAAAAAAAAAAAAAAA
GOLD IN 13	TTTCCAGATCGTCACCCTCAGCATGACCTTCAAAAAAAAAAAAAAA
GOLD IN 14	ATCAAGAATAACGCCAAAAGGACAGGATTAAAAAAAAAAAAAAAA
GOLD IN 15	TAAAGCCTCAAACTCCAACAGGTATTACGAGGAAAAAAAAAAAAAAA
GOLD IN 16	AACCAGGCTCGATGAACGGTAATCAATCGGAAAAAAAAAAAAAAA
GOLD IN 17	CGCTGGCATTCCACACAACATACGGTGCCGGAAAAAAAAAAAAAAAA
GOLD IN 18	GCGTTTTAACATTATGACCCTGGGAGCAAAAAAAAAAAAAAAA
GOLD IN 19	ATCCTTGAATCATTTTGCGGAACAAAATATCAAAAAAAAAAAAAAAA
GOLD IN 20	CATAGCTCACCCGCCGCGCTTACTGTCCAAAAAAAAAAAAAAA
GOLD IN 21	CACGCAAATCAATATCTGGTCAAAGTTTGAAAAAAAAAAAAAAAA

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GOLD IN 22              AGTGAGGCTGAAAGGAATTGAGAAATCCAAAAAAAAAAAAAAA
GOLD IN 23              TGCCCGAAAGAAGAGTCAATAGAAACAAAAAAAAAAAAAA
GOLD IN 24              CGTTTTAGGACAAAGAACGCGAGATGAATTTAAAAAAAAAAAAAAAA
GOLD IN 25              AATCGCAACGAACCTCCCGACTAATTTTAAAAAAAAAAAAAAA
GOLD IN 26              TGAGCCATTTTTGCACCCAGCTACTGCGGGAGGAAAAAAAAAAAAAAA
GOLD IN 27              GTACTCAGCACCAGTAGCACCATTCACCGACAAAAAAAAAAAAAAA
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TRACK STRANDS FOR TUBE ‘A’

S1*	ATCCCACTCCCTACACTTCGTGGAACCTCAGCCCAACTAACATCGTCACTCCACAATGCTTTCGCAAAAAAAAGGCTCCACAAATAAA
S2	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAAAAATCTCAGGTGAATTTCTTAGGCTTGAG
S3	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATCTGAATTCACCACCAGAGCCGCCGGAAACCG
S4	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAACCAGAACTACCGTTCCAGTAACAACTAAA
S5	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAGAACTGGCAATATCAGAGAGATAATAAGTCCT
S6	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATGAGCGCTATGATTAAGACTCCAGAACCGC
S7	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAACGAGCATGAGCCAACGCTCAACAGAAGAAAACA
S8	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAACAGTATAATAGAAACCAATCAAAGAATTAA
S9	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATACCTTTTTTGTTTGGATTATACTAGGTGAGG
S10	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAAATCCTGATTAATGGAAACAGTAAGCCTGT
S11	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAACGCTGAGCAAACTATCGGCCTTGAGAAAGGA
S12	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAGAAGAACTAGCCAGCAGCAAATCATATTCC
S13	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAACGCTGGCATTCCACACAACATACGGTGCCGGA
S14	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAGCTCACAAAGTGTAGCGGTCACATACTTCT
S15	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATGCGCAACATTGCCTGAGAGTCTTAATACTTT
S16	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAATCAGGTCTGTTGGGAAGGGCGAATCATGGT
S17	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATAAAAATTGCAAAGCGGATTGCATTGCCAGAG
S18	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAAGTCAGAATTTAGAACCCTCATACCGGAGAG
S19	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAACGTCCAATGATAAATTGTGTCGATAAAACGAA
S20	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAACATCGCCTACTGCGGAATCGTCAACCATAAA
S21	TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATTTGACCCAGAACCGCCACCCTCTGTATCACC

S1* has a 5' extension to capture the 5’ TET label (CGAAGTGTAGGGAGTGGGAT) so that movement of the cargo away from S1* can be monitored by fluorescence.

TRACK STRANDS FOR TUBE ‘B’

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S1   TTTACACTTCGTGGAACCTCAGCCCAACTAACATCGTCACTCCACAATGCTTTCGCAAAAAAAAGGCTCCACAAATAAA
S2    TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAAAAATCTCAGGTGAATTTCTTAGGCTTGAG
S3   TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAATCTGAATTCACCACCAGAGCCGCCGGAAACCG
S4   TTTACACGATCTACATTGGAACCTCAGCCCAACTAACATTCACTCCACAAACCAGAACTACCGTTCCAGTAACAACTAAA
S5*  CCTTTTACTTCCACTACCCATGGAACTTCAGCCCAACTAACATTCACTCCACAAGAACTGGCAATATCAGAGAGATAATAAGTCCT
```

S5* has a 5' extension to capture the 5' Cy5 label (TGGGTAGTGGAAGTAAAAGG) so that arrival of the cargo at S5* can be monitored by fluorescence. S1* is modified with a single mismatch (underlined) to trap the cargo when it arrives at S5*.

MOTOR STRAND: CGATGTTAGTTGGGCTGAGGTTCC

3. Origami assembly. Scaffold, staples and block staples were mixed in a ratio of 1:3:5 in a buffer containing 1x Sybr Green (Invitrogen), 50 mM NaCl,10 mM $MgCl_2$,1 mM EDTA and 10 mM Tris-HCl at pH8.0. DNA nanotubes were assembled by cooling from 96°C to room temperature at 1°C per minute and melted by heating at the same rate. The fluorescence signal can be used to report the fraction of base pairs formed as a function of temperature since Sybr Green fluoresces more strongly when bound to double-stranded DNA than when bound to single-stranded DNA. Figure S3 shows the derivative of the fluorescence signal with respect to temperature (dF/dT) as a function of temperature. Peaks corresponding to the folding and melting transitions are observed at 54°C and 62°C. The assembly temperature can be decreased to 32°C by including 20% formamide in the assembly buffer.

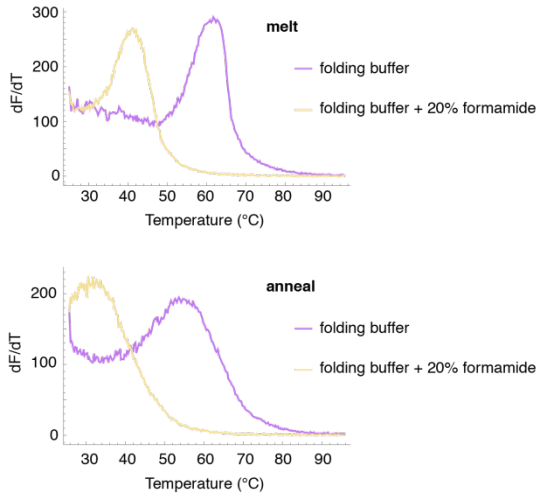

Fig S3. Assembly of Chiral Nanotubes. The melting and annealing profiles were measured in the presence of 1x Sybr Green 1 in 10 mM Tris-HCl, 1 mM EDTA, 50 mM NaCl and 10 mM $MgCl_2$ at pH8.0. Samples were cooled/heated at 1°C per minute in the presence and absence of 20% formamide. dF/dT is the first derivative of the fluorescence signal with respect to temperature.

4. Electron microscopy of chiral nanotubes.

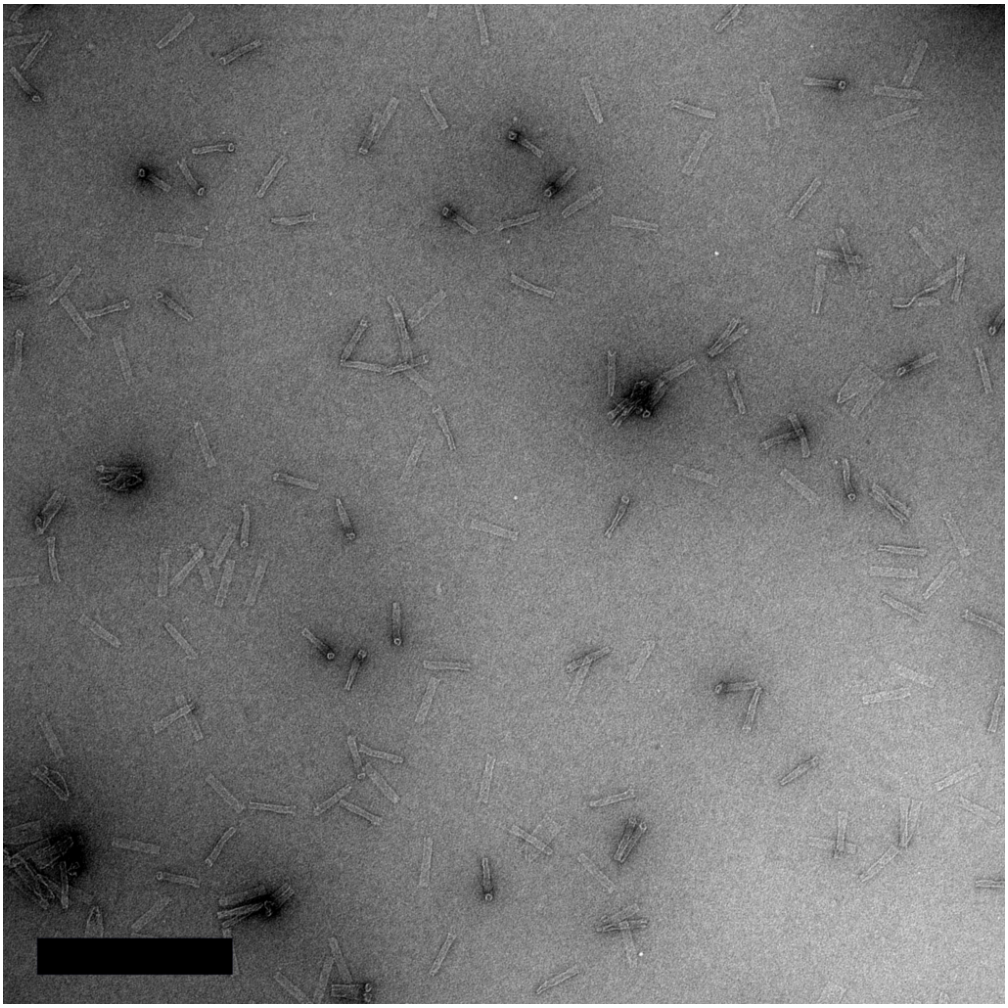

Fig S4. Chiral nanotubes before decoration with gold nanoparticles. Scale bar 500 nm.

5. CD of chiral nanotubes.

Preparation of nanoparticles. 40 mg of BSPP (Bis(p-sulfonatophenyl) phenylphosphine dihydrate dipotassium salt) was added to 50 mL of 10 nm citrate-stabilized colloidal gold nanoparticles (BBI Solutions, 9.5 nM) and the solution was stirred overnight in the dark at room temperature. To obtain a high concentration of stable nanoparticles, sodium chloride (5 M) was added in increments while agitating the solution until a colour change from red to blue was observed. The nanoparticles were sedimented by centrifugation at 1,600 rcf for 30 min at room temperature in a 50 mL Falcon tube. The clear supernatant was removed with a pipette immediately and the particles were dissolved in 1.6 mL of 2.5 mM BSPP in H_2O followed by addition of an equal volume of methanol. As before, the mixture was centrifuged and the supernatant was completely removed. The particles were resuspended in 600 μL of 2.5 mM BSPP in H_2O. The nanoparticle concentration was determined by measuring the absorption at 520 nm.

Attachment of DNA to nanoparticles. A 5'-thiol modified 19 nt polyT oligonucleotide was incubated overnight in 20 mM TCEP (Tris-(carboxyethyl) phosphine hydrochloride) then purified using a NAP-5 size exclusion column (GE Healthcare). The reduced oligonucleotide was incubated with the stabilized nanoparticles in a 300:1 ratio in 0.5x TBE at room

temperature. NaCl was gradually added over the course of 24 hours to a final concentration of 350 mM. To estimate the yield of the conjugation, a droplet of the DNA-covered AuNPs was mixed with a droplet of 0.5 × TBE buffer with 100 mM $MgCl_2$ (stable conjugation should show no colour change at $MgCl_2$ concentrations up to 100 mM). If the colour of the droplet changed from red to blue, more thiolated oligonucleotides were added. The nanoparticle–DNA conjugates were centrifuged for 5 min at 14,000 rcf at room temperature in a 30kDa MWCO centrifugal filter (Amicon Ultra, Millipore). The centrifugation step was repeated 4 times with the addition of 480 µL 0.5x TBE to the centrifugal filter before each step. The nanoparticle-DNA solution was transferred to a new Amicon filter and the four centrifugation steps were repeated. After the last step, the concentration was determined by measuring the absorption at 520 nm.

Decoration of chiral nanotubes with nanoparticles. Nine attachment sites, each consisting of three staples with a 15 nt polyA sequence at the 3' end were generated by replacing the core staples with GOLD staples. Attachment sites on the outside of the tube were generated by replacing staples annotated with superscript *a* and *b* with GOLD staples. Attachment sites on the inside of the tube were generated by replacing staples annotated with *a* with GOLD IN staples. A special set of BLOCK strands was used in which the T_8 tails were replaced with C_8 tails to avoid unwanted interaction with the gold attachment sites. Chiral nanotubes were folded as described above except that the excess of gold attachment sites was reduced to 1.2-fold. Free staples were removed by three rounds of PEG precipitation. For each round an equal volume of 12.5 mM $MgCl_2$, 0.5 M NaCl, 15% PEG (w/v) and 1x TAE was added and the samples were spun at 20,000 rcf for 30 minutes at 20°C (see reference 28 of the accompanying manuscript). Nanoparticle-DNA conjugates were mixed with PEG purified nanotubes in a 50:1 ratio of nanoparticles: DNA attachment sites. Nanopartcle-decorated nanotubes were purified away from free nanoparticles using a 1% agarose 0.5× TBE gel supplemented with 11 mM $MgCl_2$ and run at 60V for 2h. Gel-purified nanoparticle decorated nanotubes were stained with uranyl acetate and imaged by transmission electron microscopy (Fig. S5). The concentration of purified gold-functionalized DNA nanotubes is difficult to determine accurately but is estimated to be 1.5-2 nM.

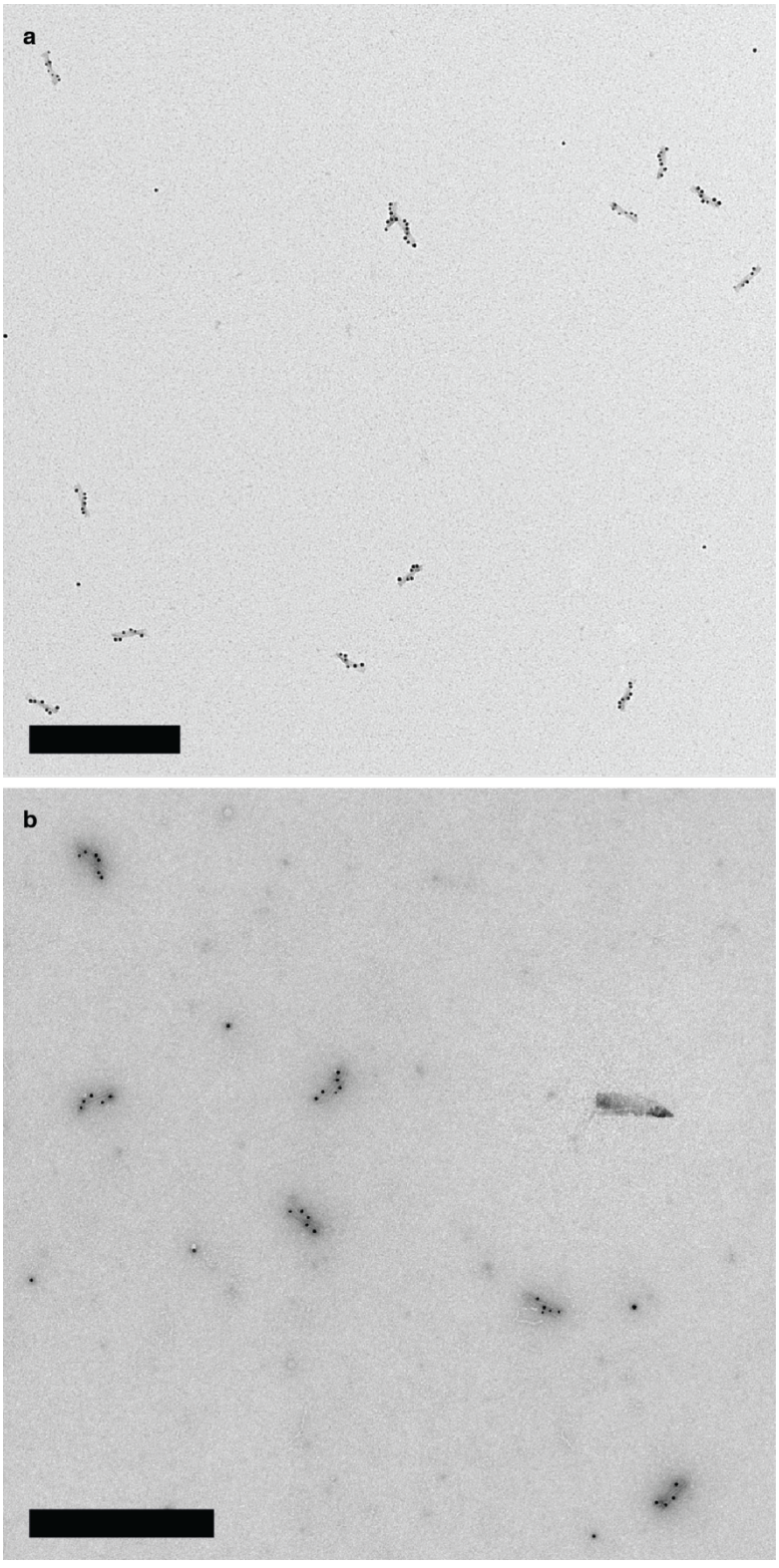

Fig S5. Chiral nanotubes decorated with 10 nm gold nanoparticles. (**a**) Chiral nanotubes with attachment sites on the outside surface. (**b**) Chiral nanotubes with attachment sites on the inside surface. Scale bar 500 nm.

Prior to the CD measurements, the samples were silver enhanced for 4 min using 0.7 μl of the enhancement solution (HQ Silver, Nanoprobes) added to 20 μl of sample as described in ref. 18 of the accompanying manuscript. The CD signal was measured in a JASCO J-815 instrument using a 1 mm path length cuvette (Starna, 21/Q1).

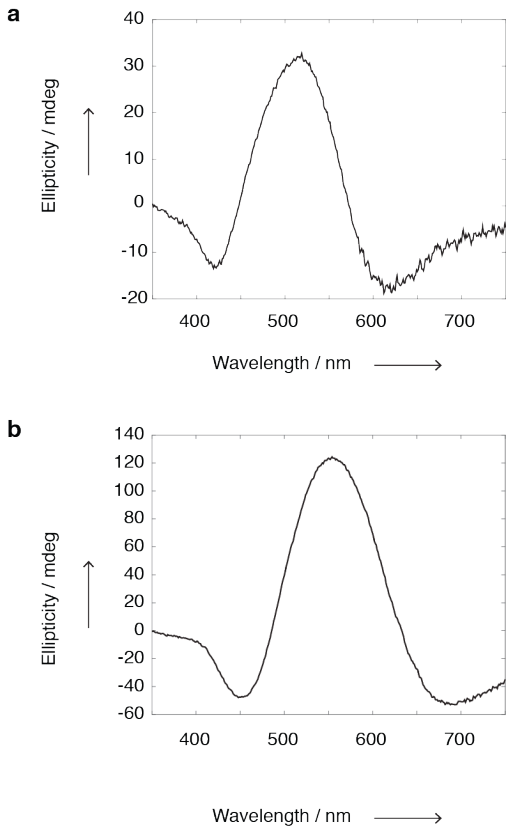

Fig S6. CD spectrum of gold-functionalized DNA nanotubes. a) Data from Fig. 3c of the manuscript showing for DNA nanotubes with gold attachment sites on the outside surface **b**) DNA nanotubes with attachment sites on the inside surface prepared as described above except that the silver enhancement was done with a 1:1 ratio of enhancer to DNA.

5.Transport of cargo within nanotubes. The start stator S1* (5 μM) was annealed with Motor (4.75 μM) and TET label (10 μM) at 6°C per minute in a buffer containing 12.5 mM $MgCl_2$ in 1× TAE (pH 8.0).

Tube A and B (50 nM scaffold) were annealed separately at 1°C per minute in a buffer containing 12.5 mM $MgCl_2$ in 1× TE. Tube A consists of all stators except S1* (S2-S21) and all remaining staples except the right-hand edge Block staples. Tube B consists of all stators (S1-S5*) and all staples except the left-hand edge Block staples.

The motor was loaded at the start of Tube A by incubating 50 nM tubes with 45 nM Motor:S1*:TET label for 1 hour at 37°C. Tube A loaded with Motor at S1* was purified using 3 passes through an S-300 spin column equilibrated a buffer containing 12.5 mM $MgCl_2$ in 1× TAE (pH 8.0).

Tubes A and B were linked by mixing 10 nM Tube A, 10 nM Tube and 10 nM Link staples. The mixture was supplemented with 50 mM potassium acetate for compatability with the nicking enzyme Nt.BbvCI. The 135 μL mixture was incubated in a cuvette at 37°, 200 μL of mineral oil was placed over the sample to prevent evaporation. After 2 hours (at t=0), movement of the motor along the track was initiated by adding 1 μL of Nt.BbvCI (10 units). At the end of the reaction Motor (2.34 μL) was added to a final concentration of 2.6 μM to record a fully quenched baseline.

The unlinked A + B sample preparation was identical except both tubes were decorated with Block staples on both left and right-hand edges. No Linker staples were added.