

ELECTRONIC SUPPLEMENTARY INFORMATION

Computational study on the intramolecular self-organization of the macrorings of some 'giant' cyclodextrins (CD_n, n = 40, 70, 85, 100)

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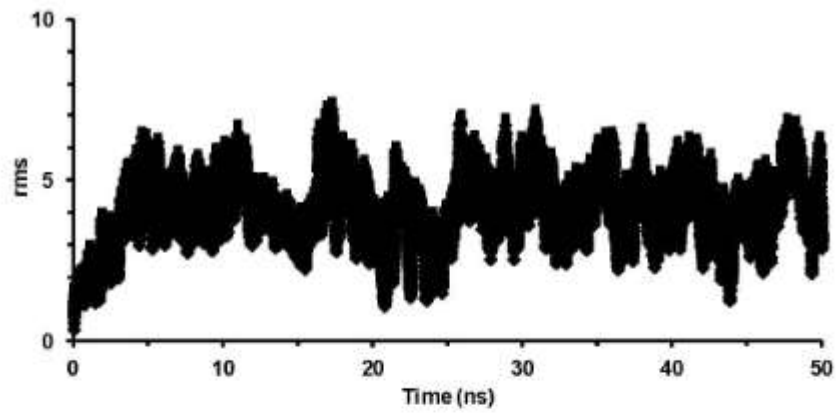
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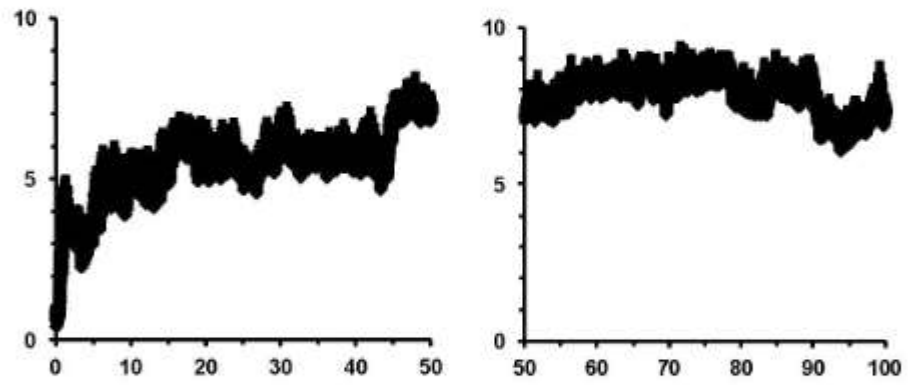
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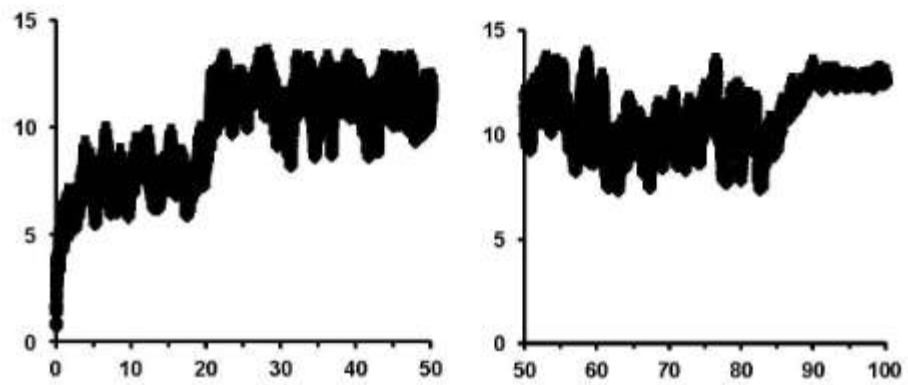
CD14



CD26



CD40



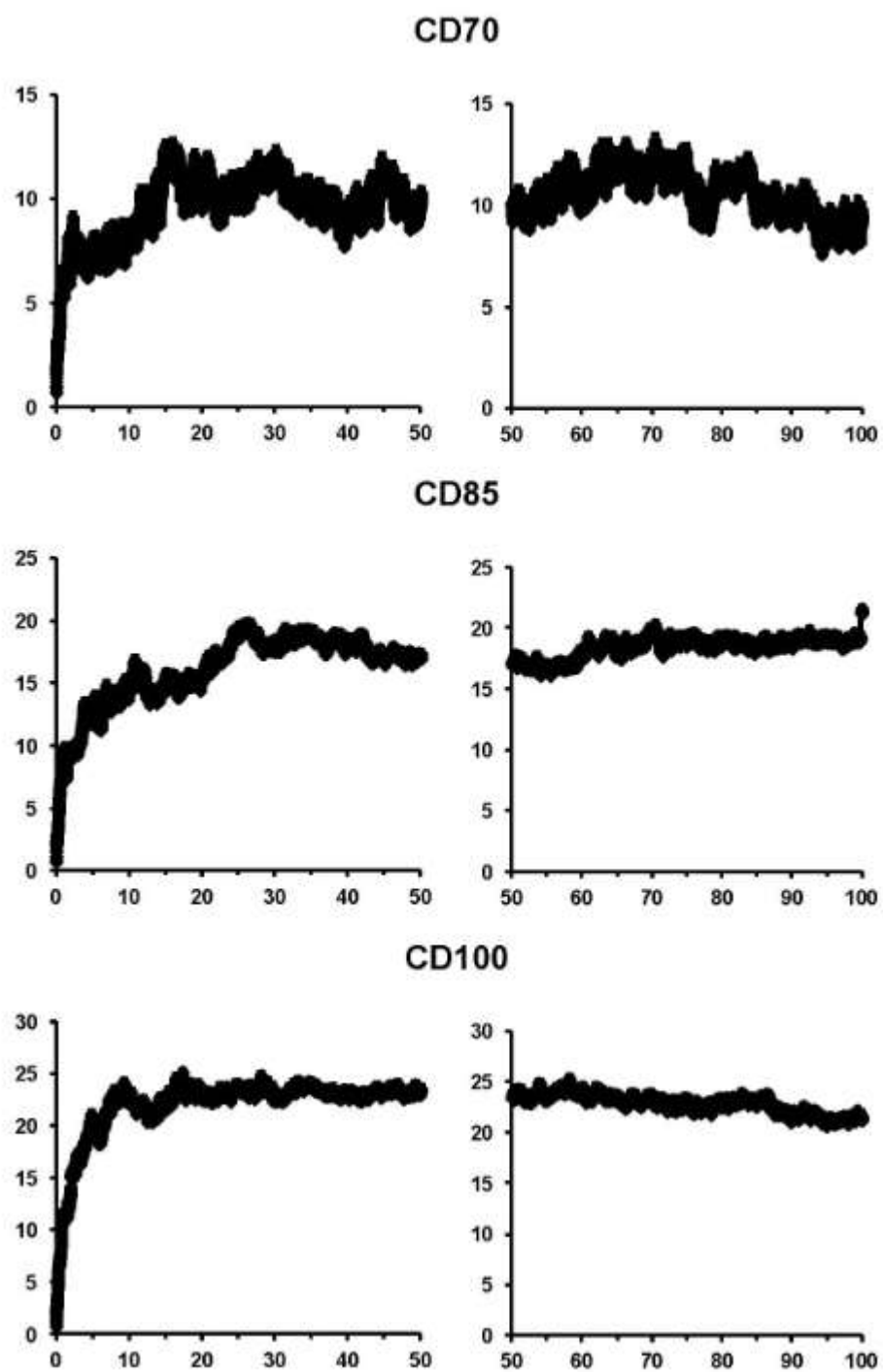


Fig. S8. Rms deviations of atomic coordinates (in Å) relative to the starting set of coordinates.

Table S1. - Computed Distances (Å), Bond Angles and Dihedral Angles (in degrees) of Neighboring Glucose Units Obtained from the MD Simulations in Water and Comparison with Experimental Determinations (experimental data from Table 1 of Ref. [1] and Ref. [23])^a

		CD6	CD7	CD8	CD9	CD10	CD14	CD26 ^b
I. Experimental Data								
Number of glucose units		6	7	8	9	10	14	26
Cavity diameter		4.7-5.3	6.0-6.5	7.5-8.3				
Height of the cone		7.9±1	7.9±1	7.9±1				
Volume of the cavity		174	262	472				
Φ	av.	109.2	109.8	108.9	112.1	99.4	103.4	103.6
	min.	102.0	102.3	103.6	88.4	94.1	96.6	91.1
	max.	114.9	118.6	123.2	141.2	102.1	110.2	115.3
Ψ	av.	128.8	127.6	127.1	124.7	106.1	112.6	115.3
	min.	115.1	114.2	111.9	97.6	96.3	103.6	97.4
	max.	148.7	140.0	138.5	144.5	122.0	135.2	131.4
O4(n)...O4(n-1) ...O4(n-2)	av.	119.9	128.3	134.9	136.6	138.2	138.2	126.4
	min.	116.9	125.2	133.5	125.7	126.7	131.6	117.9
	max.	122.3	132.5	136.9	149.9	145.9	142.5	136.7
O4(n)...O4(n-1)	av.	4.24	4.38	4.50	4.49	4.49	4.54	4.39
	min.	4.16	4.27	4.43	4.26	4.36	4.45	4.11
	max.	4.30	4.50	4.59	4.73	4.63	4.61	4.56
O2(n)...O3(n-1)	av.	2.98	2.88	2.82	2.91	2.93	2.83	2.86
	min.	2.90	2.80	2.76	2.74	2.85	2.76	2.65
	max.	3.15	2.98	2.91	3.23	3.01	2.90	3.10

Table S1. – (continued)

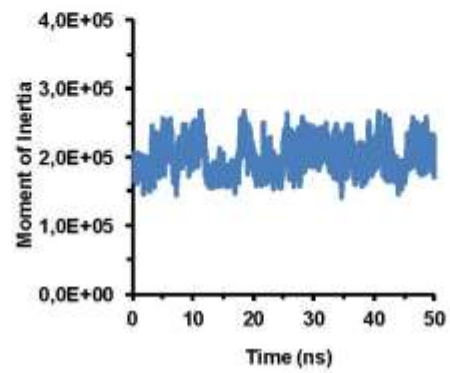
II. Computed Data								
	O4(n)...O4(n-1)				O2(n)...O3(n-1)			
	av.	rms	max.	min.	av.	rms	max.	min.
CD14	4.7	0.2	5.9	3.6	3.8	0.5	6.3	2.4
CD26	4.7	0.2	6.0	3.0	3.8	0.5	6.6	2.4
CD40	4.7	0.2	5.9	2.7	3.7	0.6	6.3	2.4
CD70	4.7	0.2	5.9	2.8	3.6	0.5	6.5	2.4
CD85	4.7	0.2	5.9	2.6	3.7	0.5	6.3	2.5
CD100	4.7	0.2	6.1	2.9	3.8	0.5	6.6	2.4
	C1(n)—O4(n-1)—C4(n-1)				O4(n)...O4(n-1)...O4(n-2)			
	av.	rms	max.	min.	av.	rms	max.	min.
CD14	115.5	3.7	134.3	99.0	138.4	9.6	179.5	81.1
CD26	115.8	3.8	135.4	98.2	135.1	10.0	179.7	62.6
CD40	115.1	3.8	134.4	97.9	142.3	8.9	179.9	78.8
CD70	115.3	3.7	136.1	98.5	139.3	8.1	179.9	78.4
CD85	115.3	3.8	135.2	97.9	139.9	8.2	179.8	75.5
CD100	115.3	3.8	138.9	97.8	141.4	8.0	179.9	70.7
	O4(n)...O4(n-1)...O4(n-2)...O4(n-3)				O3(n)...C4(n)...C1(n+1)...O2(n+1)			
	av.		rms		av.		rms	
CD14	-5.2		27.6		-18.8		25.7	
CD26	-4.1		22.6		-16.7		24.6	
CD40	-28.7		35.6		-42.8		29.1	
CD70	-15.9		27.1		-27.7		25.1	
CD85	-25.3		28.8		-37.3		25.3	
CD100	-29.9		30.1		-42.2		25.9	

Table S1. – (continued)

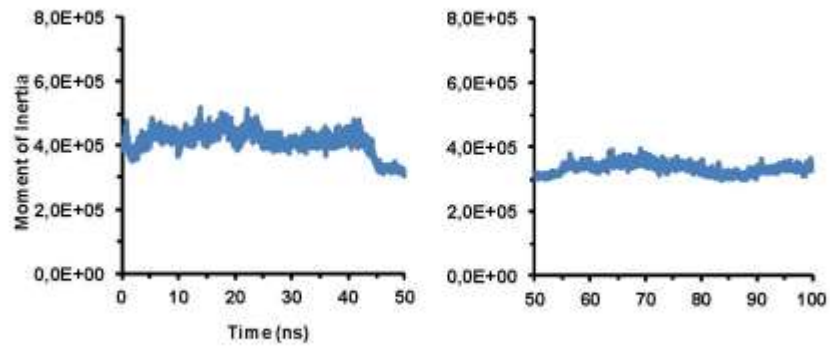
	Φ		Ψ	
	O5(n)—C1(n)—O4(n-1)—C4(n-1)		C1(n)—O4(n-1)—C4(n-1)—C3(n-1)	
	av.	rms	av.	rms
CD14	88.2	15.9	81.4	16.1
CD26	89.1	14.2	81.5	18.9
CD40	86.4	16.3	93.5	19.6
CD70	90.9	15.7	91.8	17.4
CD85	86.6	15.4	91.6	16.1
CD100	84.4	14.9	88.7	17.2

^a Units are: distances (Å), angles (°), volumes (Å³). ^b The data refer to the helical part.

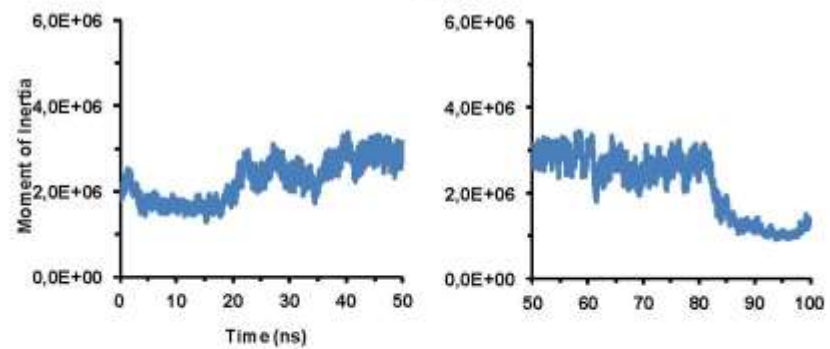
CD14



CD26



CD40



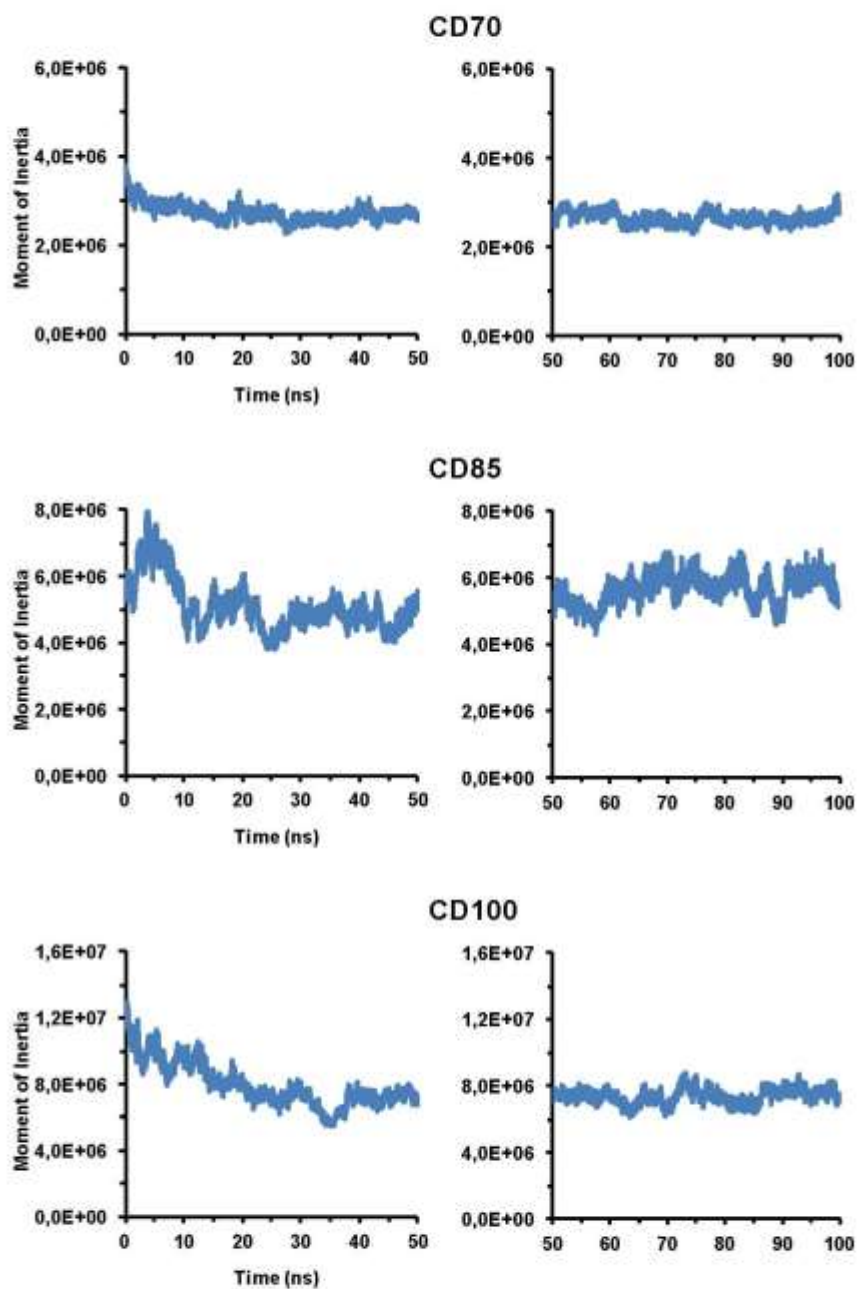
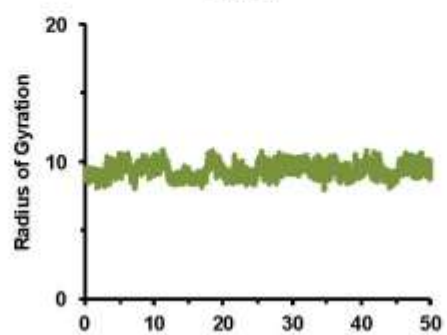
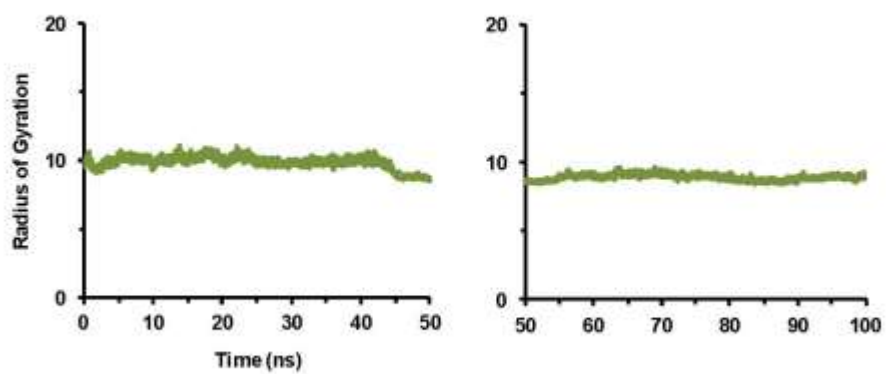


Fig. S9. Variation with the time of the moments of inertia.

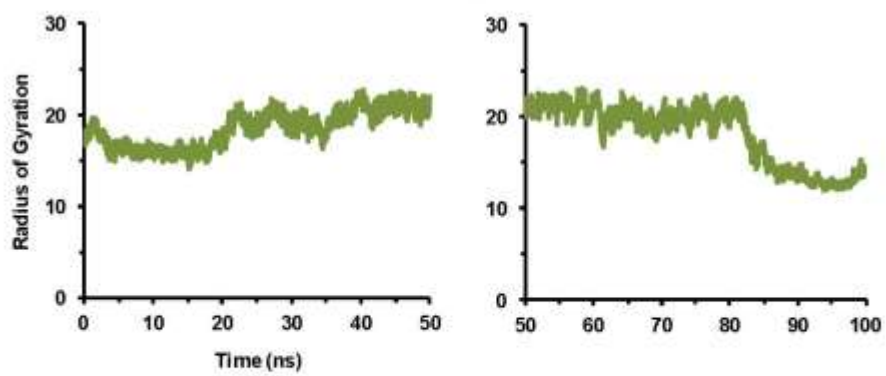
CD14



CD26



CD40



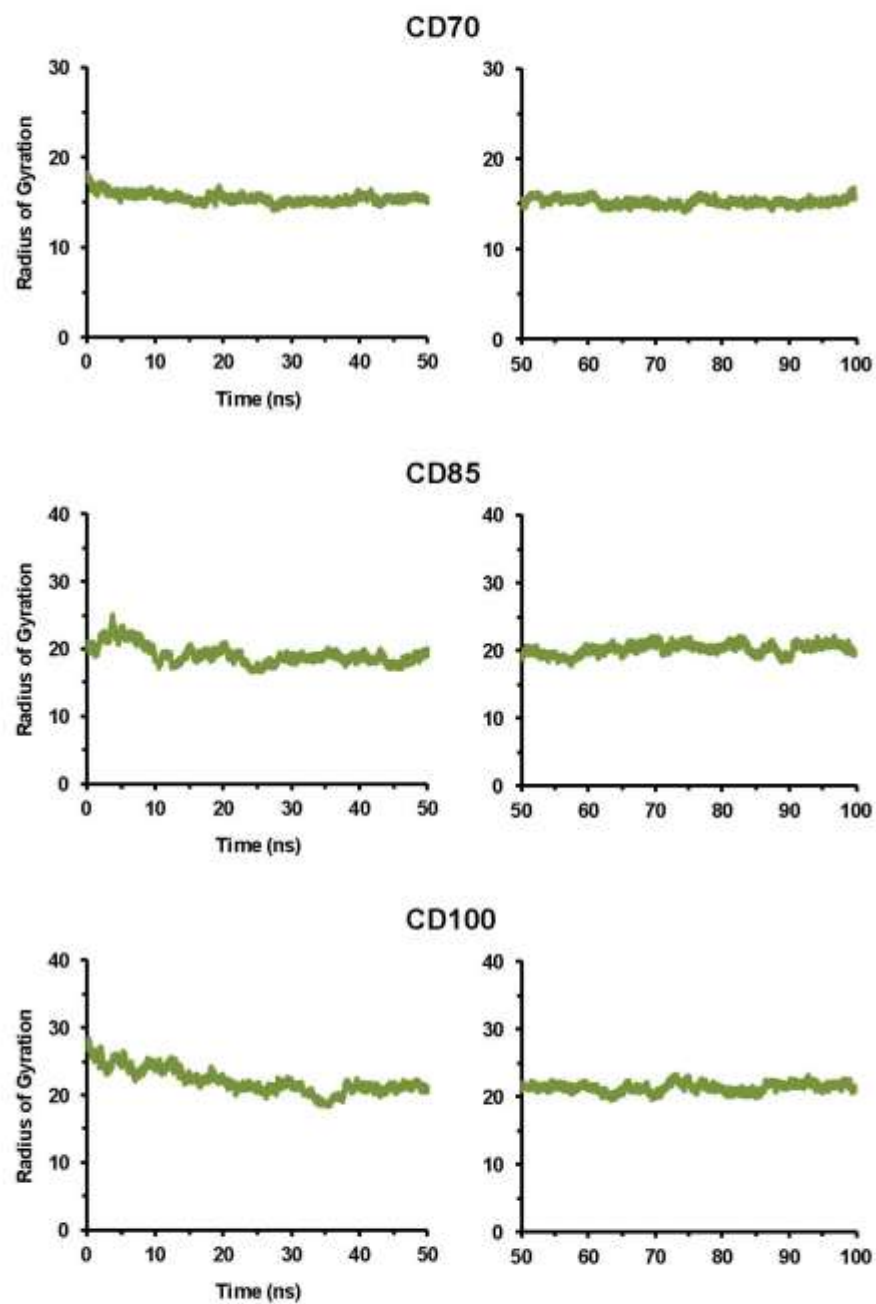
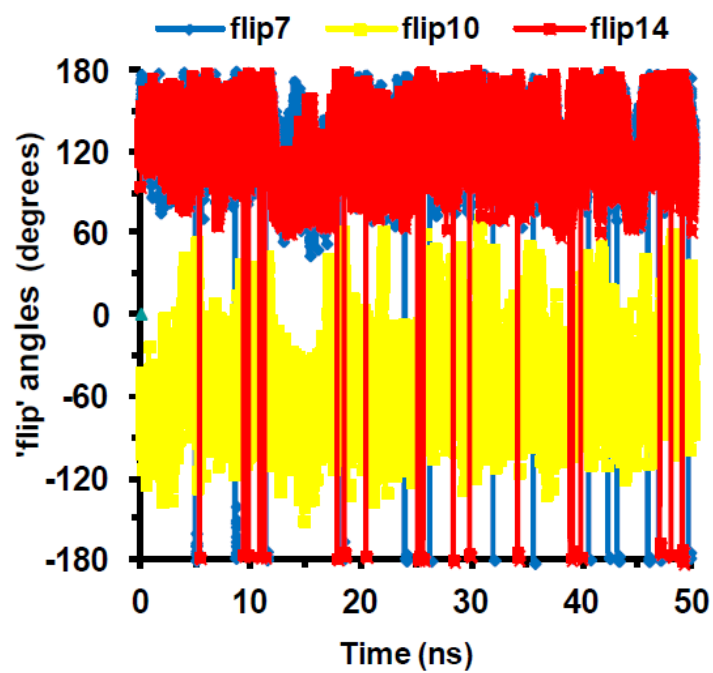
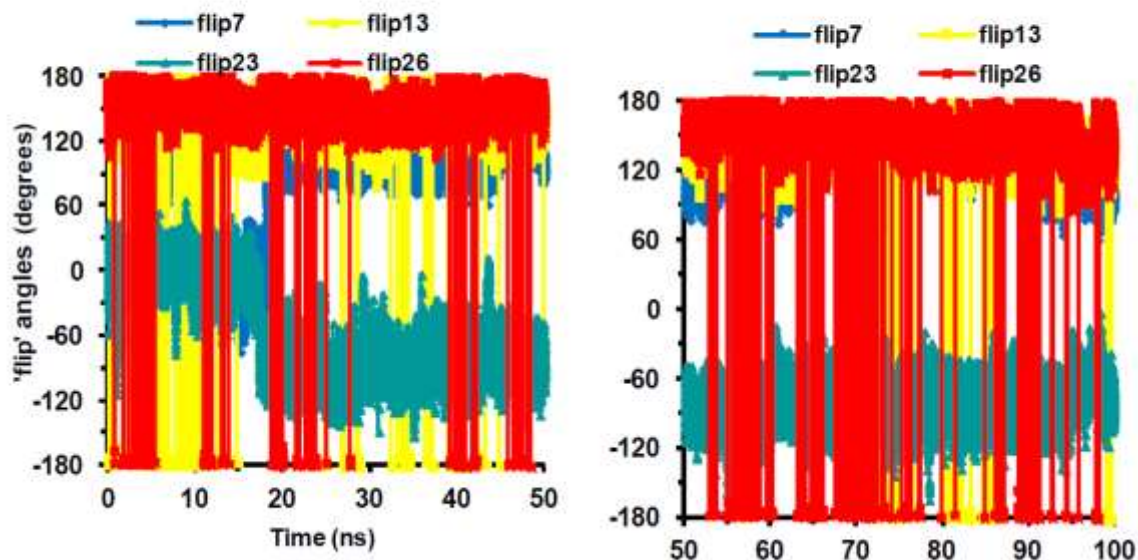


Fig. S10. Variation with the time of the radius of gyration.

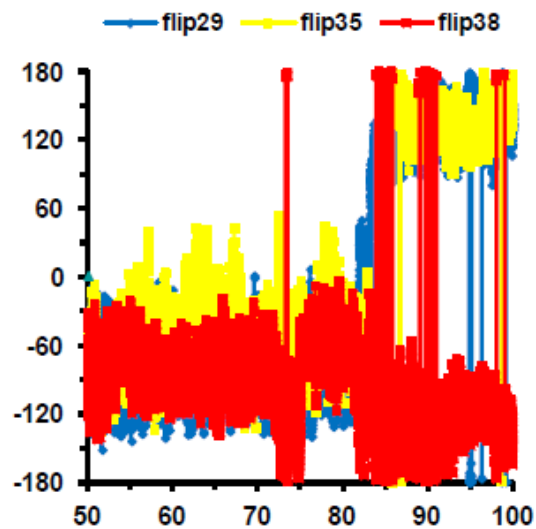
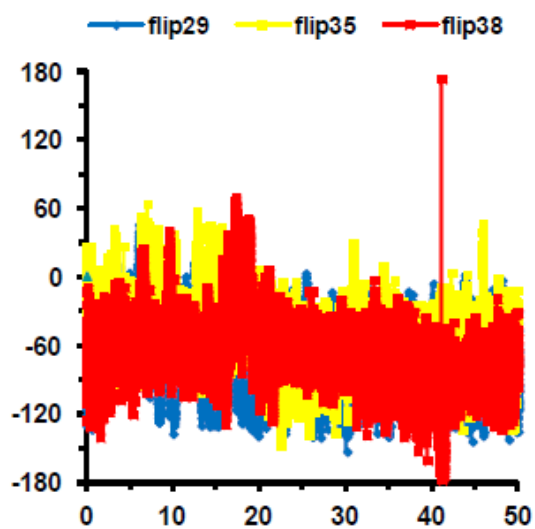
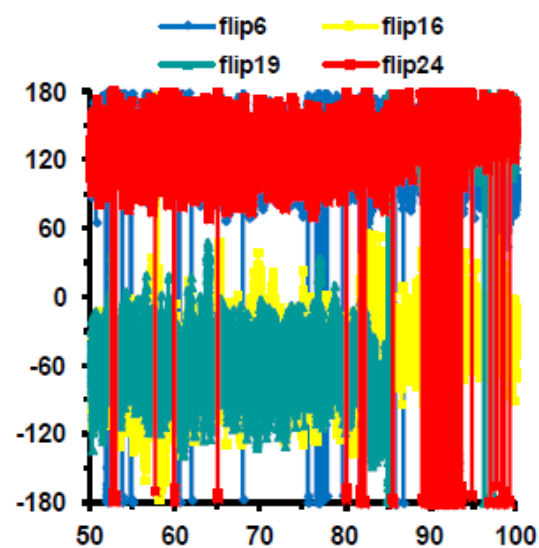
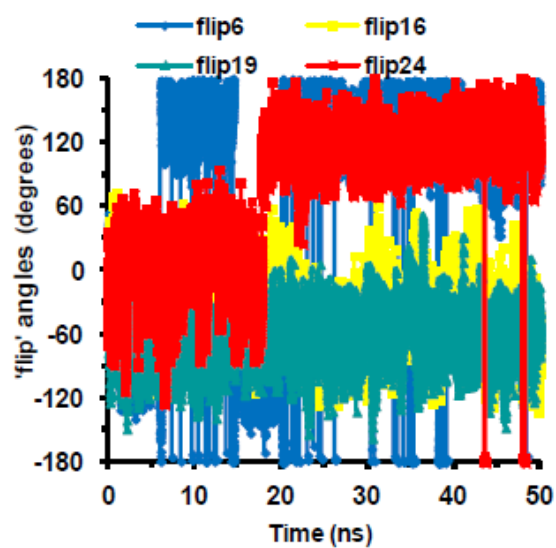
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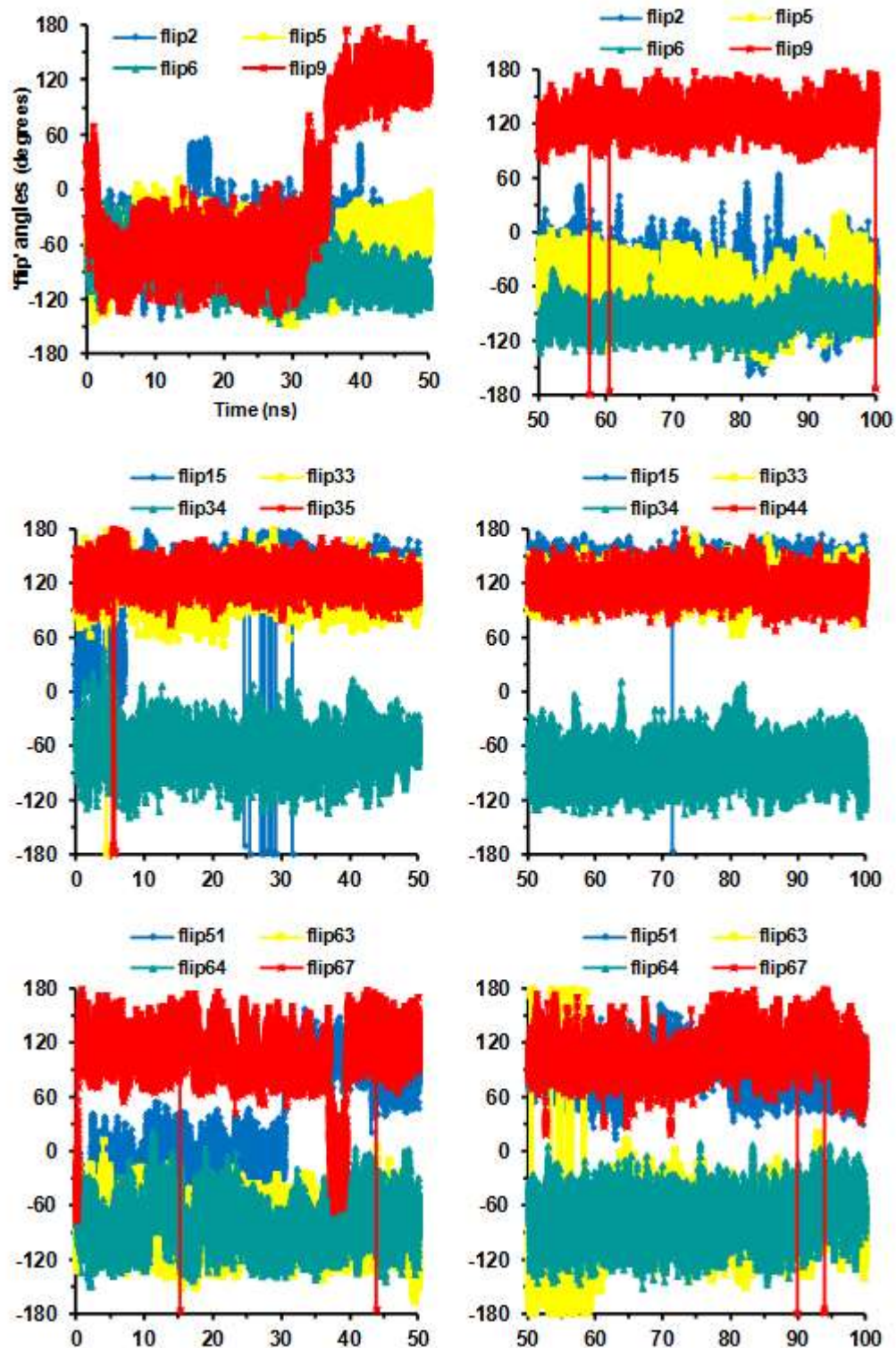
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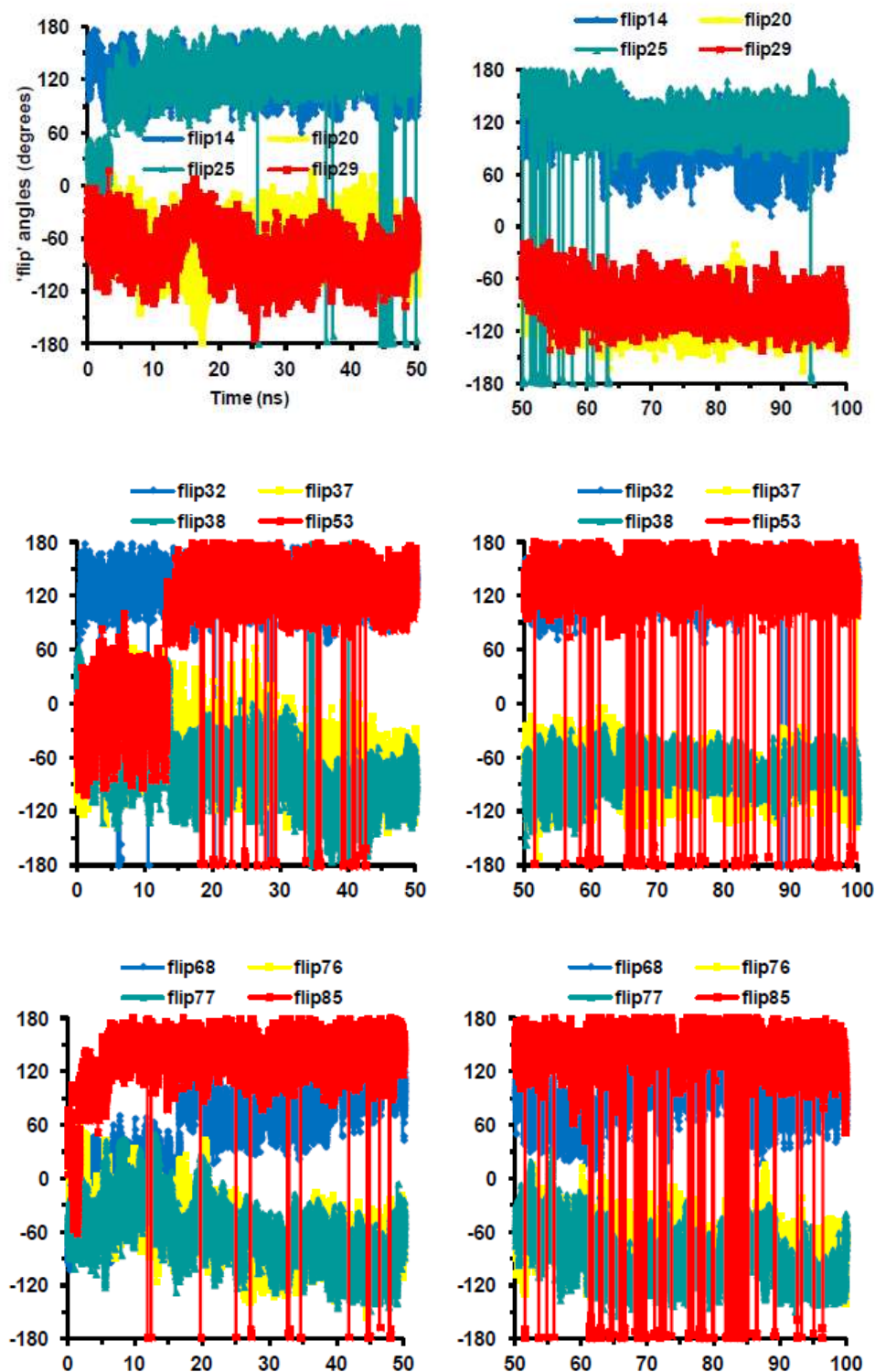
CD40



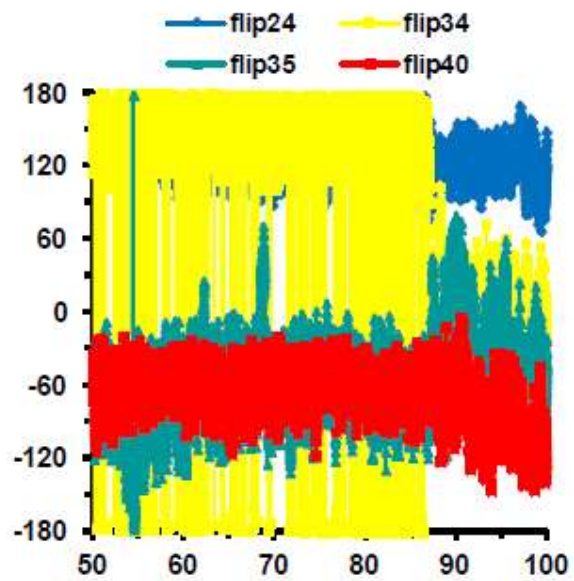
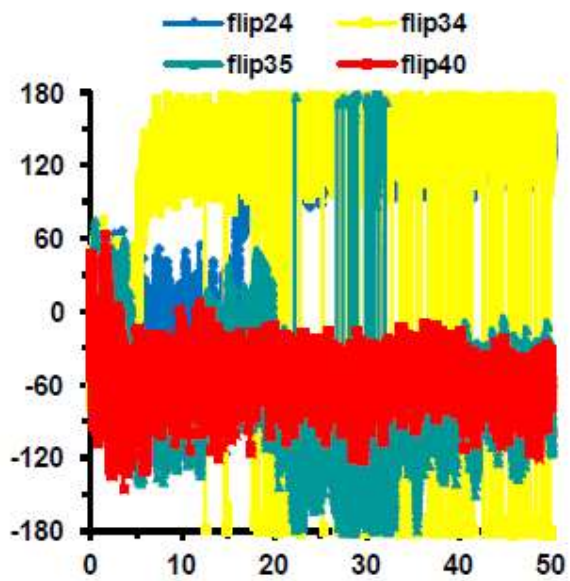
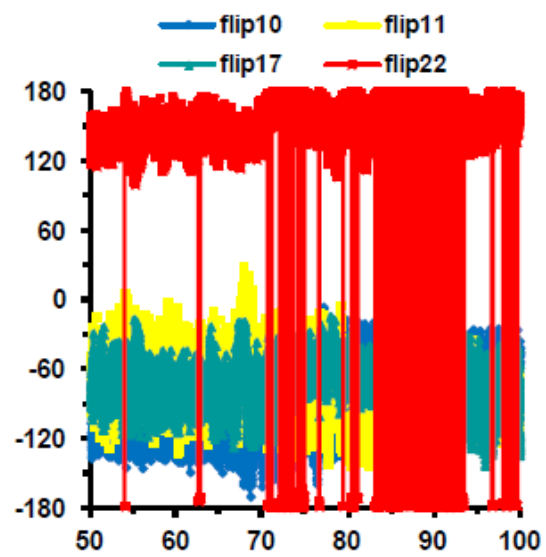
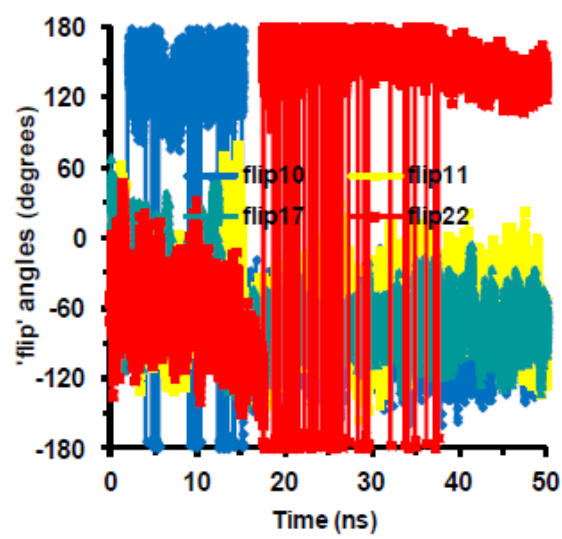
CD70



CD85



CD100



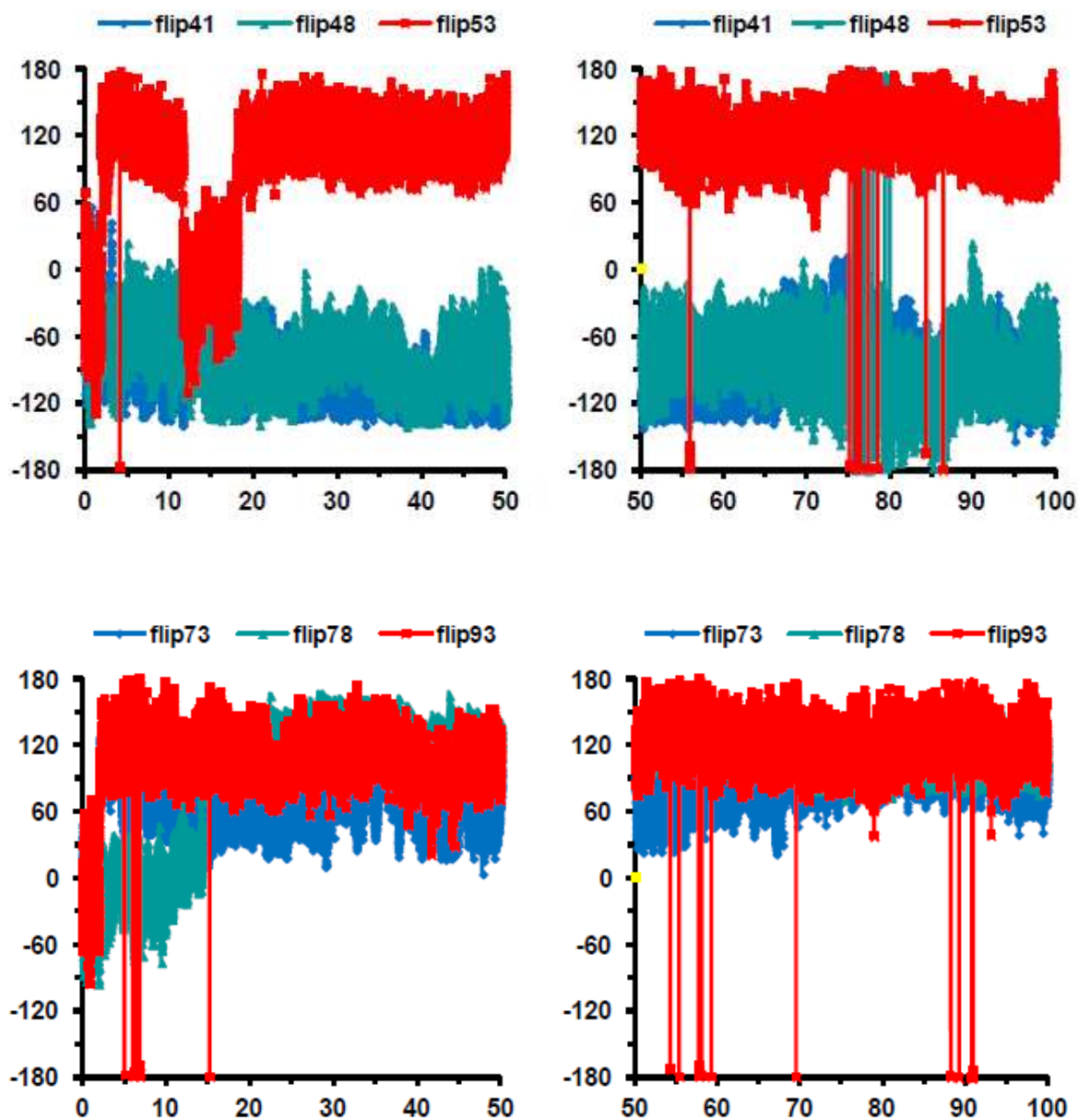
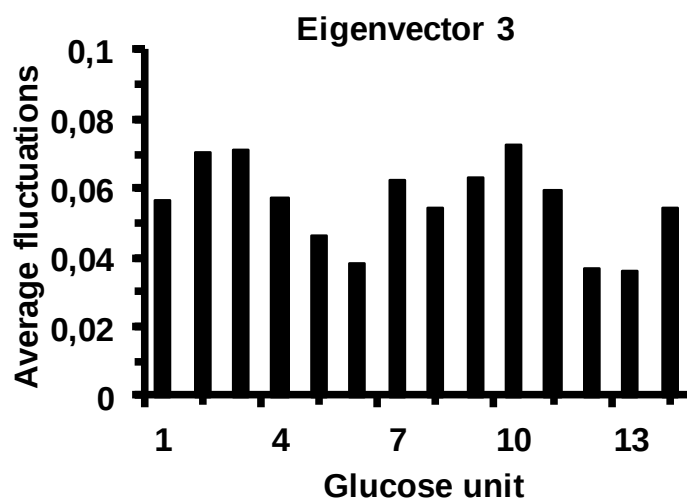
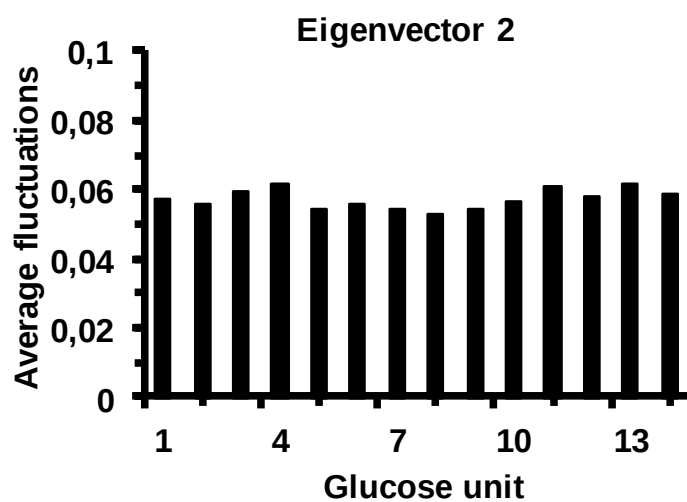
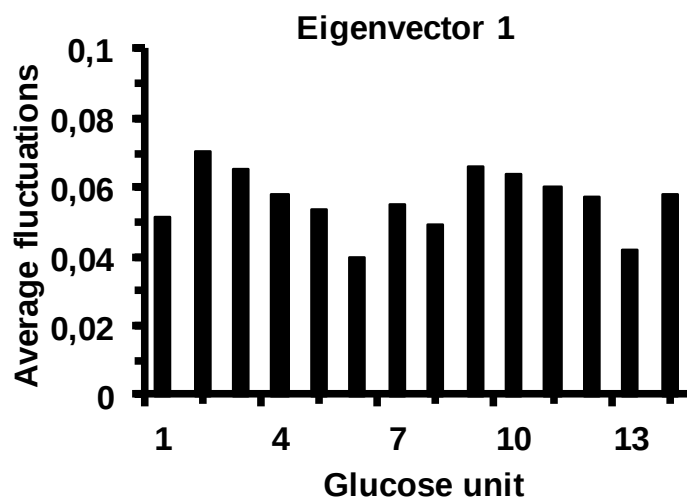
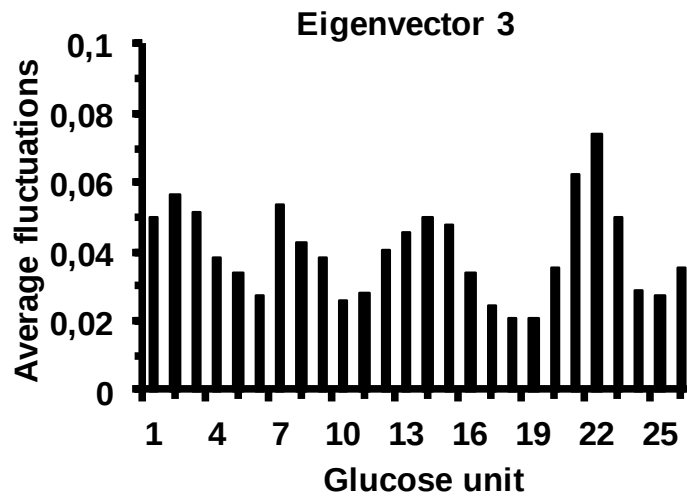
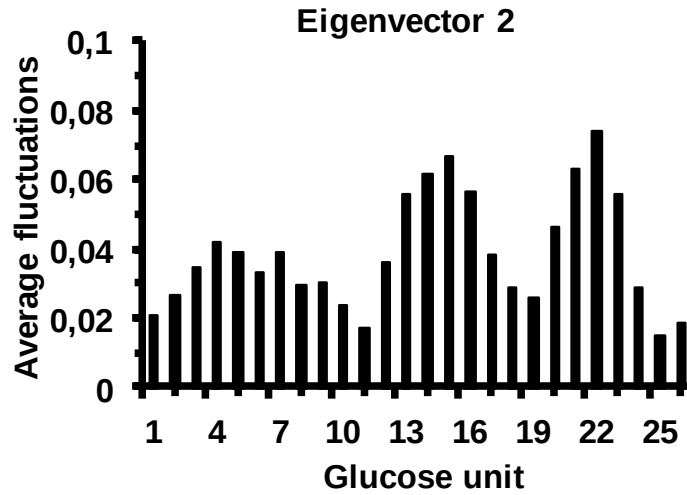
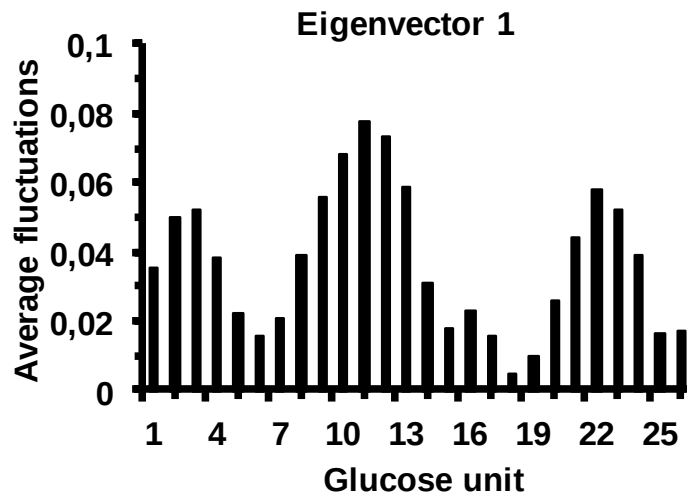


Fig. S11. Variation of *flip* angles.

CD14

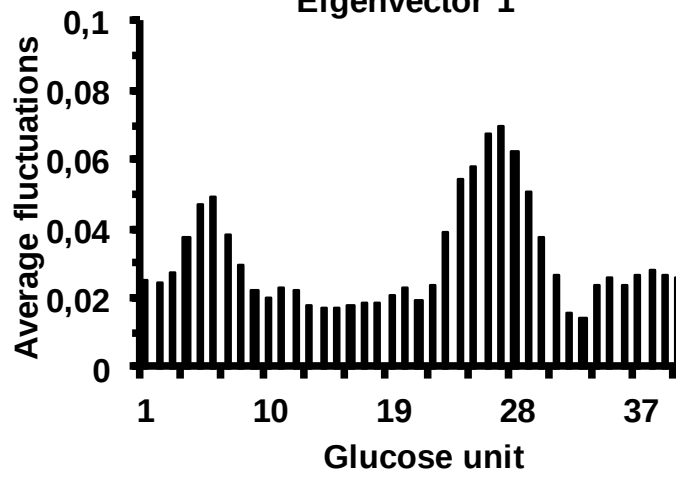


CD26

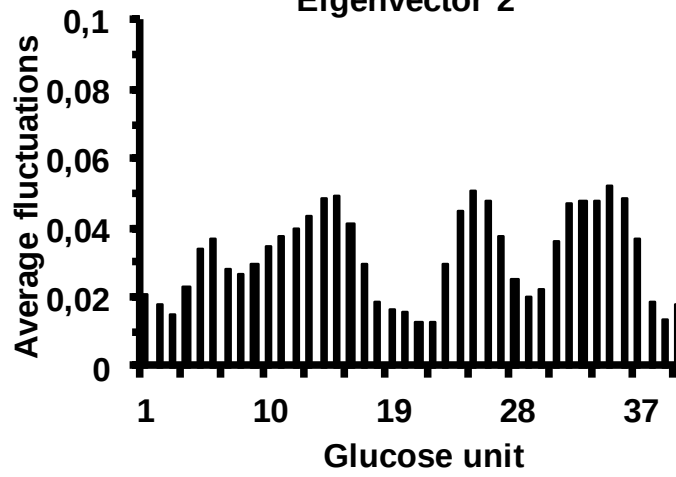


CD40

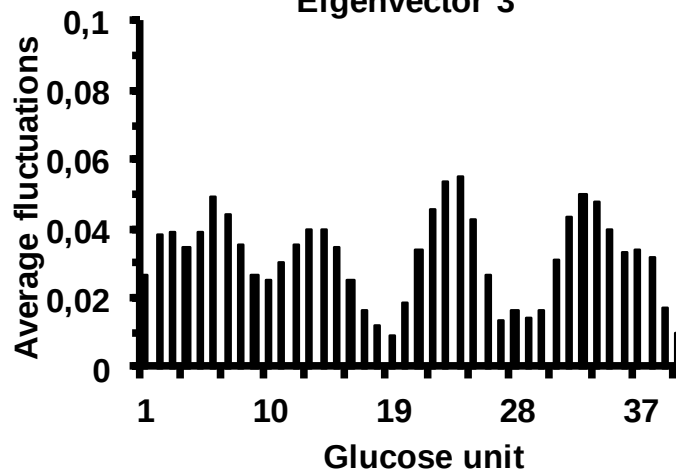
Eigenvector 1



Eigenvector 2

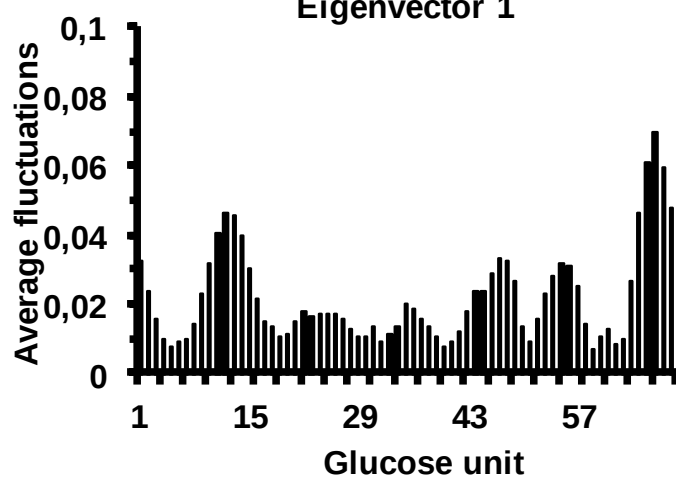


Eigenvector 3

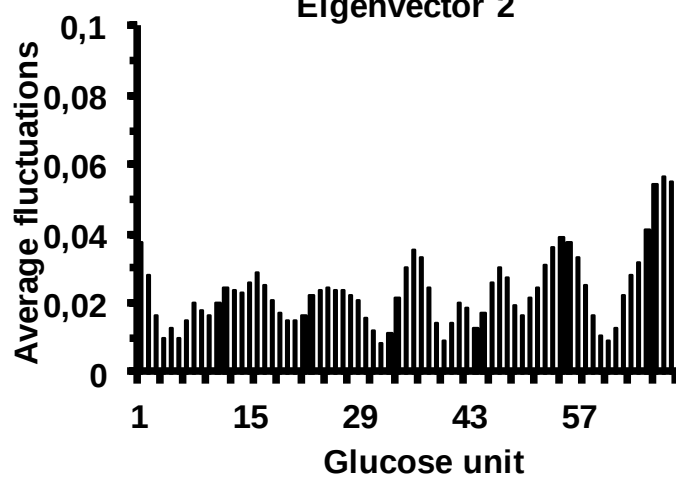


CD70

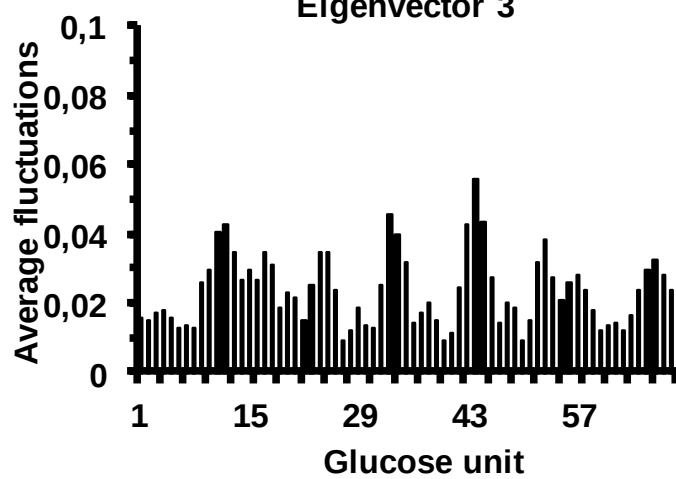
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Eigenvector 2

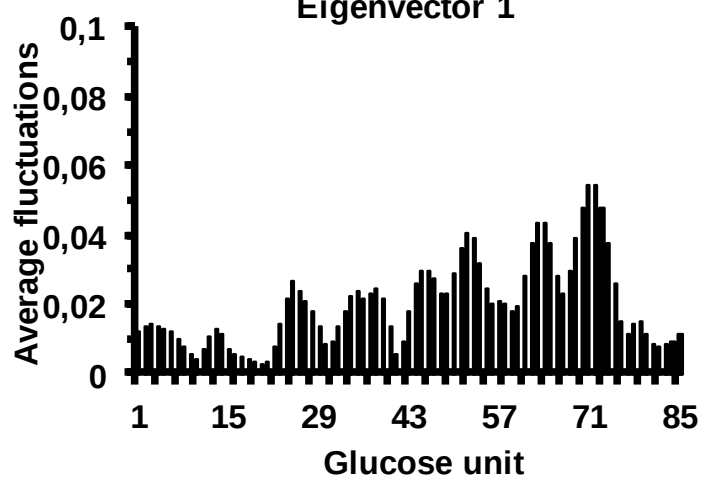


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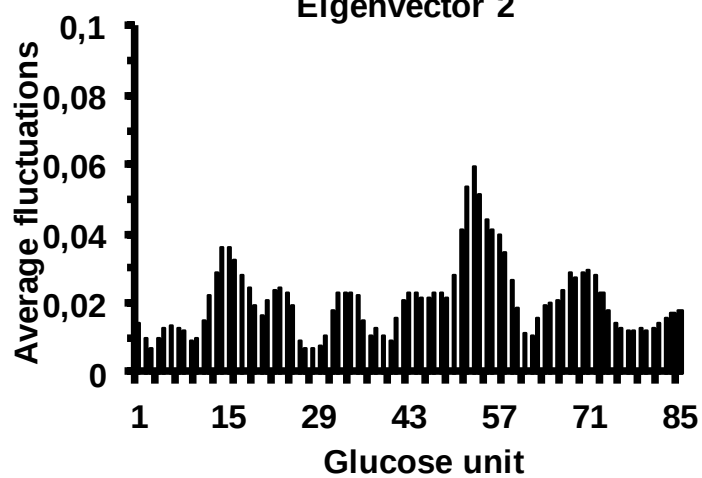


CD85

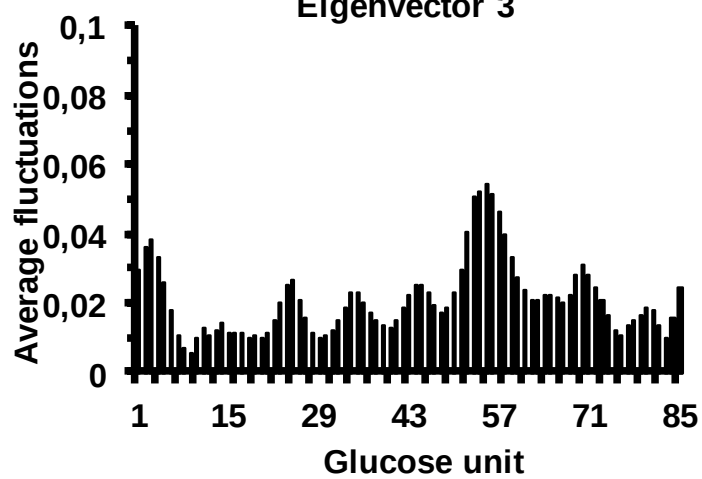
Eigenvector 1



Eigenvector 2



Eigenvector 3



CD100

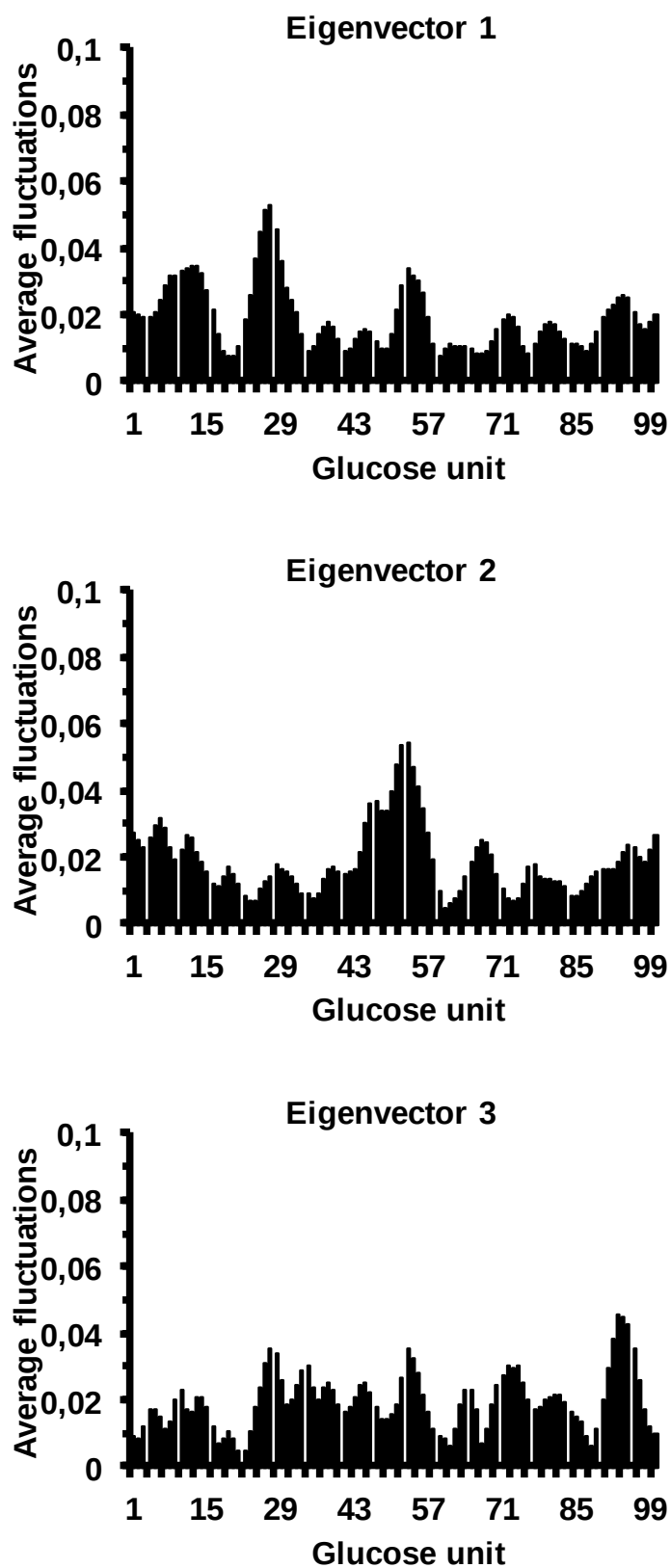


Fig. S12. Fluctuations of atomic coordinates (in Å) for each residue, averaged over the first three animated eigenvectors.

Table S2. - Principal component analysis of the conformational variations^a

Simulation interval (from ... ns to ... ns)	0.0 to 10.0	10.0 to 20.0	20.0 to 30.0	30.0 to 40.0	40.0 to 50.0	50.0 to 60.0	60.0 to 70.0	70.0 to 80.0	80.0 to 90.0	90.0 to 100	0.0 to 100.0 ^b
CD14 ($N_{at} = 294$; $Q = 90.1 - 90.5$)											
N_{ev}	12	9	13	16	13						13
total variance	1683.5	2253.2	1683.6	1390.4	1645.3						1892.1
explained variance	1516.2	2039.4	1520.9	1255.8	1483.9						1709.5
CD26 ($N_{at} = 546$; $Q = 90.0 - 90.4$)											
N_{ev}	12	24	44	56	8	41	58	58	55	41	9
total variance	3644.2	2393.6	1258.5	968.9	3899.8	1295.5	969.6	932.7	955.1	1281.0	6797.9
explained variance	3292.7	2156.4	1132.8	872.1	3515.7	1166.2	873.9	840.2	859.9	1153.6	6141.8
CD40 ($N_{at} = 840$; $Q = 90.1 - 91.4$)											
N_{ev}	14	11	13	13	14	12	13	12	6	14	11
total variance	19218.3	18319.4	13949.6	16552.6	12388.3	14800.9	12927.9	15464.4	37342.9	6681.8	44633.3
explained variance	17435.9	16611.7	12631.9	15009.1	11164.9	13412.2	11648.4	13979.2	34139.6	6019.1	40503.7
CD70 ($N_{at} = 1470$; $Q = 90.1 - 90.6$)											
N_{ev}	15	18	18	24	18	20	29	10	22	21	14
total variance	20169.9	14187.1	13807.1	9864.5	12321.8	8866.4	7344.0	16254.8	9006.4	8994.1	33504.8
explained variance	18252.7	12819.7	12479.1	8890.4	11142.2	7997.4	6613.1	14629.6	8122.8	8117.7	30356.1
CD85 ($N_{at} = 1785$; $Q = 90.0 - 90.5$)											
N_{ev}	10	12	7	13	12	18	12	18	16	17	11
total variance	89693.3	45322.4	50322.7	29070.6	25217.4	18831.6	27613.1	14297.9	16731.0	14072.6	108727.9
explained variance	80738.9	40896.6	45515.0	26198.7	22756.2	16951.6	24907.6	12894.7	15104.8	12717.6	98074.3
CD100 ($N_{at} = 2100$; $Q = 90.1 - 90.5$)											
N_{ev}	8	10	20	12	23	24	22	18	16	19	14
total variance	176660.6	79654.6	27849.8	36672.4	21895.7	22860.6	22920.8	32124.5	32417.5	26596.8	135510.1
explained variance	159402.1	72075.6	25109.7	33039.4	19758.3	20657.9	20703.0	28932.8	29191.7	24038.7	122336.7

Table S2 (continued)

Eigenvector	Eigenvalues										
CD14											
1	841.3	1299.3	743.0	541.8	761.5						797.8
2	232.9	361.8	283.9	310.4	271.6						407.5
3	151.9	116.0	210.7	100.6	161.0						163.6
4	89.1	72.9	73.4	68.8	84.6						80.4
5	57.6	64.9	51.4	66.3	50.9						70.2
6	40.3	46.9	44.1	38.2	35.0						49.6
7	26.4	35.6	26.5	23.3	28.9						35.2
8	20.0	23.9	21.5	20.7	23.7						23.8
9	16.8	18.1	19.8	17.4	18.2						21.8
10	15.9		15.3	16.0	15.5						20.0
CD26											
1	2061.6	659.9	326.8	264.5	2908.9	549.9	269.2	242.3	333.1	361.0	4414.2
2	433.8	393.3	267.3	108.5	289.2	167.1	124.1	115.4	89.7	212.1	664.4
3	298.6	254.4	102.8	100.7	107.5	71.8	68.1	95.2	57.3	134.4	346.6
4	121.0	186.1	78.4	61.6	62.6	53.5	47.2	50.0	52.2	78.7	238.1
5	95.3	149.8	49.1	38.6	52.6	43.4	38.7	37.8	35.5	53.7	146.0
6	89.6	91.1	40.3	34.2	39.4	31.2	35.2	31.2	31.0	39.4	119.1
7	51.2	67.0	25.7	24.3	29.3	22.6	30.5	28.3	25.2	33.3	87.4
8	44.3	54.4	22.8	18.0	26.3	19.1	24.6	19.7	23.7	26.6	67.8
9	31.0	50.0	21.7	17.3		17.1	20.5	15.7	22.2	21.8	58.1
10	24.9	42.2	17.3	14.6		16.1	18.0	13.7	15.3	17.4	
CD40											
1	5634.8	8177.1	4768.6	6002.5	3572.4	5560.9	4378.3	4778.7	23260.4	2988.5	20073.1
2	4147.6	3014.8	2323.4	2628.9	1785.4	3164.4	2997.8	4060.1	6453.5	1113.9	6052.1
3	2706.6	2254.7	1554.5	2340.4	1514.4	1431.1	1053.1	1982.2	2409.5	747.1	4675.7
4	1348.9	869.0	1031.2	964.2	986.5	888.1	711.2	794.3	716.4	239.0	2804.9
5	880.2	573.6	804.4	699.5	806.0	494.1	590.2	627.0	702.5	207.7	1573.7
6	639.3	507.9	536.1	643.9	595.1	458.3	409.3	381.4	597.2	147.6	1369.4
7	492.4	380.8	431.2	455.3	404.8	410.0	382.6	350.7		119.9	1303.4
8	406.3	260.9	305.1	342.6	329.7	287.8	313.7	302.7		107.4	819.4
9	296.0	236.2	245.8	244.6	299.2	278.9	237.9	247.1		85.7	672.9
10	240.7	176.3	185.7	225.8	247.2	170.8	205.1	191.1		71.7	627.6

Table S2 (continued)

CD70											
1	7156.1	5836.1	5460.9	3238.7	4399.1	3564.0	2314.4	9748.3	3991.3	3003.1	15107.3
2	4038.5	2059.1	2481.7	1885.3	2620.2	1948.8	1249.4	1525.9	1025.4	1656.3	5593.4
3	2099.7	943.1	1121.8	835.0	1021.7	747.6	720.5	952.1	731.3	994.3	3037.1
4	1226.9	846.6	880.8	518.1	771.1	393.1	436.8	693.8	541.3	670.2	1573.1
5	1134.4	742.8	576.2	377.9	505.9	223.8	348.2	426.9	384.5	498.7	1213.8
6	841.3	560.4	556.6	335.7	390.7	204.8	244.1	347.1	259.6	256.4	763.4
7	410.7	338.0	240.2	283.6	276.4	163.8	218.2	314.8	212.3	200.5	557.4
8	247.1	326.3	180.1	222.1	252.0	136.2	166.5	245.5	160.7	121.1	504.4
9	217.5	212.3	162.1	175.1	178.6	92.1	109.2	207.2	136.6	104.3	451.8
10	206.1	169.7	141.2	157.8	132.3	89.9	104.3	168.0	100.2	91.1	392.0
CD85											
1	40823.8	16007.2	21070.8	16585.0	12007.9	6672.7	11726.5	4432.6	7586.0	5140.9	43704.9
2	17840.0	10234.6	17097.4	2480.1	4729.8	3040.9	5378.3	3391.5	2069.1	2492.4	21650.6
3	6240.6	6616.4	3850.8	2096.2	1890.8	1934.5	2275.8	1651.9	1460.8	2035.5	10601.0
4	4538.1	1986.4	1444.8	1238.0	978.9	1118.2	1847.2	792.4	980.6	626.3	6922.6
5	3017.3	1155.4	814.6	794.5	846.5	975.8	855.1	489.5	671.3	575.1	4475.0
6	2183.0	988.9	677.7	628.6	580.5	657.7	812.3	339.7	554.5	445.0	2829.7
7	1902.8	932.2	558.9	549.7	494.8	415.9	546.1	312.3	376.3	279.3	2589.7
8	1710.6	760.5		488.7	346.1	404.5	396.8	286.9	278.6	210.8	1806.5
9	1298.4	697.3		387.5	283.9	328.5	338.0	233.2	246.2	189.3	1374.8
10	1184.4	615.1		294.7	233.9	269.0	263.9	209.5	199.2	144.1	1159.5
CD100											
1	92038.1	37147.9	8384.4	15510.8	6552.1	6355.5	6855.0	8211.5	11351.2	8389.3	57385.7
2	26561.1	13866.3	4913.5	7668.5	3930.4	3283.0	4466.6	6566.8	6312.1	3175.3	25051.1
3	20329.2	7998.3	2923.7	3540.6	2335.7	2354.1	2291.7	3416.1	3267.5	3020.4	8829.6
4	7230.3	3645.0	2313.0	1491.8	1422.3	1531.3	1323.8	2588.8	2117.8	2434.6	6477.9
5	4437.4	2886.2	1201.6	1208.7	850.3	1286.6	1264.8	1827.8	1304.8	1505.7	4841.6
6	4053.7	1695.4	864.9	970.1	803.8	1173.6	766.5	1560.1	1070.9	1343.7	4100.8
7	2719.4	1574.4	809.6	869.1	644.4	737.6	675.3	831.1	763.0	913.0	3299.5
8	2032.8	1268.3	673.6	522.6	478.8	606.9	459.2	694.3	615.8	549.8	2655.4
9		1120.1	438.7	421.1	415.6	478.1	378.0	608.3	418.2	481.8	2500.7
10		873.6	406.4	334.1	331.1	418.6	350.5	502.3	392.3	377.9	2081.5

Table S2 (continued)

Eigenvector	Weight (%)										
	CD14										
1	56.4	63.7	49.9	45.0	52.5						47.8
2	15.6	17.7	19.1	25.8	18.7						24.4
3	10.2	5.7	14.1	8.4	11.1						9.8
4	6.0	3.6	4.9	5.7	5.8						4.8
5	3.9	3.2	3.5	5.5	3.5						4.2
6	2.7	2.3	3.0	3.2	2.4						3.0
7	1.8	1.7	1.8	1.9	2.0						2.1
8	1.3	1.2	1.4	1.7	1.6						1.4
9	1.1	0.9	1.3	1.4	1.3						1.3
10	1.1	0.0	1.0	1.3	1.1						1.2
CD26											
1	63.4	33.9	34.3	38.8	82.7	55.4	39.8	37.3	48.6	36.9	71.9
2	13.3	20.2	28.1	15.9	8.2	16.8	18.4	17.8	13.1	21.7	10.8
3	9.2	13.1	10.8	14.8	3.1	7.2	10.1	14.7	8.4	13.7	5.6
4	3.7	9.6	8.2	9.0	1.8	5.4	7.0	7.7	7.6	8.0	3.9
5	2.9	7.7	5.2	5.7	1.5	4.4	5.7	5.8	5.2	5.5	2.4
6	2.8	4.7	4.2	5.0	1.1	3.1	5.2	4.8	4.5	4.0	1.9
7	1.6	3.4	2.7	3.6	0.8	2.3	4.5	4.4	3.7	3.4	1.4
8	1.4	2.8	2.4	2.6	0.7	1.9	3.6	3.0	3.5	2.7	1.1
9	1.0	2.6	2.3	2.5		1.7	3.0	2.4	3.2	2.2	0.9
10	0.8	2.2	1.8	2.1		1.6	2.7	2.1	2.2	1.8	
CD40											
1	33.6	49.7	39.1	41.3	33.9	42.3	38.8	34.8	68.1	51.3	50.2
2	24.7	18.3	19.1	18.1	16.9	24.1	26.6	29.6	18.9	19.1	15.1
3	16.1	13.7	12.8	16.1	14.4	10.9	9.3	14.5	7.1	12.8	11.7
4	8.0	5.3	8.5	6.6	9.4	6.8	6.3	5.8	2.1	4.1	7.0
5	5.2	3.5	6.6	4.8	7.6	3.8	5.2	4.6	2.1	3.6	3.9
6	3.8	3.1	4.4	4.4	5.6	3.5	3.6	2.8	1.7	2.5	3.4
7	2.9	2.3	3.5	3.1	3.8	3.1	3.4	2.6	0.0	2.1	3.3
8	2.4	1.6	2.5	2.4	3.1	2.2	2.8	2.2	0.0	1.8	2.0
9	1.8	1.4	2.0	1.7	2.8	2.1	2.1	1.8	0.0	1.5	1.7
10	1.4	1.1	1.5	1.6	2.3	1.3	1.8	1.4	0.0	1.2	1.6

Table S2 (continued)

CD70											
1	40.7	48.5	46.3	40.3	41.7	47.1	39.1	66.6	52.9	39.5	51.7
2	23.0	17.1	21.0	23.5	24.8	25.8	21.1	10.4	13.6	21.8	19.2
3	11.9	7.8	9.5	10.4	9.7	9.9	12.2	6.5	9.7	13.1	10.4
4	7.0	7.0	7.5	6.5	7.3	5.2	7.4	4.7	7.2	8.8	5.4
5	6.5	6.2	4.9	4.7	4.8	3.0	5.9	2.9	5.1	6.6	4.2
6	4.8	4.7	4.7	4.2	3.7	2.7	4.1	2.4	3.4	3.4	2.6
7	2.3	2.8	2.0	3.5	2.6	2.2	3.7	2.2	2.8	2.6	1.9
8	1.4	2.7	1.5	2.8	2.4	1.8	2.8	1.7	2.1	1.6	1.7
9	1.2	1.8	1.4	2.2	1.7	1.2	1.8	1.4	1.8	1.4	1.5
10	1.2	1.4	1.2	2.0	1.3	1.2	1.8	1.1	1.3	1.2	1.3
CD85											
1	50.6	40.0	46.3	64.9	53.6	42.2	48.0	36.5	52.6	42.4	45.0
2	22.1	25.6	37.6	9.7	21.1	19.2	22.0	27.9	14.3	20.5	22.3
3	7.7	16.5	8.5	8.2	8.4	12.2	9.3	13.6	10.1	16.8	10.9
4	5.6	5.0	3.2	4.8	4.4	7.1	7.6	6.5	6.8	5.2	7.1
5	3.7	2.9	1.8	3.1	3.8	6.2	3.5	4.0	4.7	4.7	4.6
6	2.7	2.5	1.5	2.5	2.6	4.2	3.3	2.8	3.8	3.7	2.9
7	2.4	2.3	1.2	2.2	2.2	2.6	2.2	2.6	2.6	2.3	2.7
8	2.1	1.9	0.0	1.9	1.5	2.6	1.6	2.4	1.9	1.7	1.9
9	1.6	1.7	0.0	1.5	1.3	2.1	1.4	1.9	1.7	1.6	1.4
10	1.5	1.5	0.0	1.2	1.0	1.7	1.1	1.7	1.4	1.2	1.2
CD100											
1	57.7	51.5	36.6	47.7	36.9	34.9	36.4	30.6	41.1	37.8	49.0
2	16.7	19.2	21.4	23.6	22.1	18.0	23.7	24.5	22.9	14.3	21.4
3	12.8	11.1	12.8	10.9	13.1	12.9	12.2	12.7	11.8	13.6	7.5
4	4.5	5.1	10.1	4.6	8.0	8.4	7.0	9.7	7.7	11.0	5.5
5	2.8	4.0	5.2	3.7	4.8	7.1	6.7	6.8	4.7	6.8	4.1
6	2.5	2.4	3.8	3.0	4.5	6.4	4.1	5.8	3.9	6.1	3.5
7	1.7	2.2	3.5	2.7	3.6	4.0	3.6	3.1	2.8	4.1	2.8
8	1.3	1.8	2.9	1.6	2.7	3.3	2.4	2.6	2.2	2.5	2.3
9	0.0	1.6	1.9	1.3	2.3	2.6	2.0	2.3	1.5	2.2	2.1
10	0.0	1.2	1.8	1.0	1.9	2.3	1.9	1.9	1.4	1.7	1.8

^a N_{at} – number of atoms; N_{ev} – number of eigenvectors; Q - quality of the compression (%). ^b 0.0 to 50.0 ns for CD14.