Supporting Information for:

NMR structures of small molecules bound to a model of an RNA CUG repeat expansion

Jonathan L. Chen[1,2†], Amirhossein Taghavi[3†], Alexander J. Frank[4], Matthew A. Fountain[4], Shruti Choudhary[1], Soma Roy[3], Jessica L. Childs-Disney[3], Matthew D. Disney[1,3*]

[1]Department of Chemistry, The Scripps Research Institute, 130 Scripps Way, Jupiter, FL 33458, USA

[2]Department of Biochemistry and Biophysics, Center for RNA Biology, University of Rochester Medical Center, Rochester, NY 14642, USA

[3]Department of Chemistry, The Herbert Wertheim UF Scripps Institute for Biomedical Innovation & Technology, 130 Scripps Way, Jupiter, FL 33458, USA

[4]Department of Chemistry and Biochemistry, State University of New York at Fredonia, Fredonia, NY 14063, USA

† These authors contributed equally.

* Author to whom correspondence should be addressed: mdisney@ufl.edu or disney@scripps.edu

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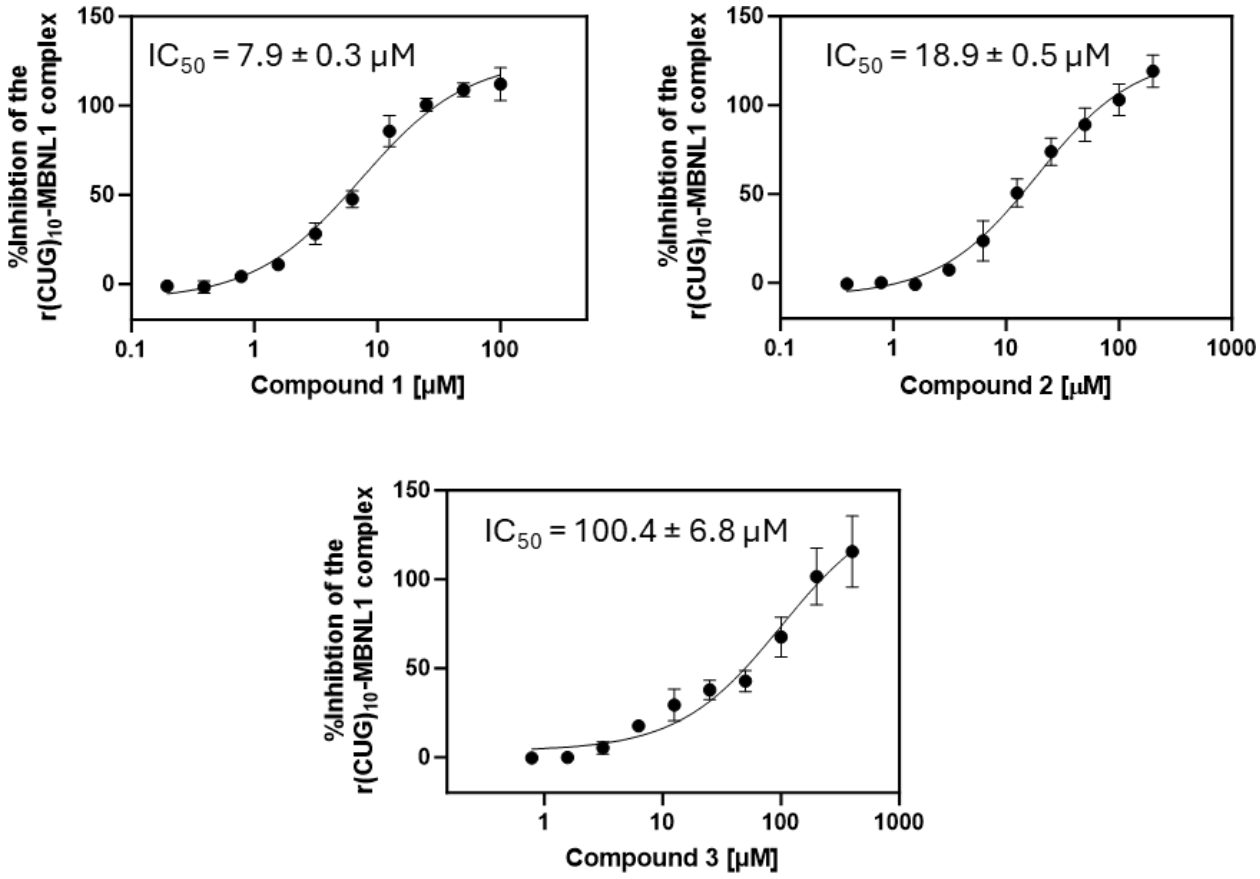

Figure S1: **In vitro inhibition of the r(CUG)^{exp}-MBNL1 complex by compounds 1, 2, and 3.** A previously reported time-resolved fluorescence resonance energy transfer (FRET) assay[1] was used to measure the percent inhibition of a r(CUG)$_{12}$-MBNL1 complex to generate IC_{50} curves.

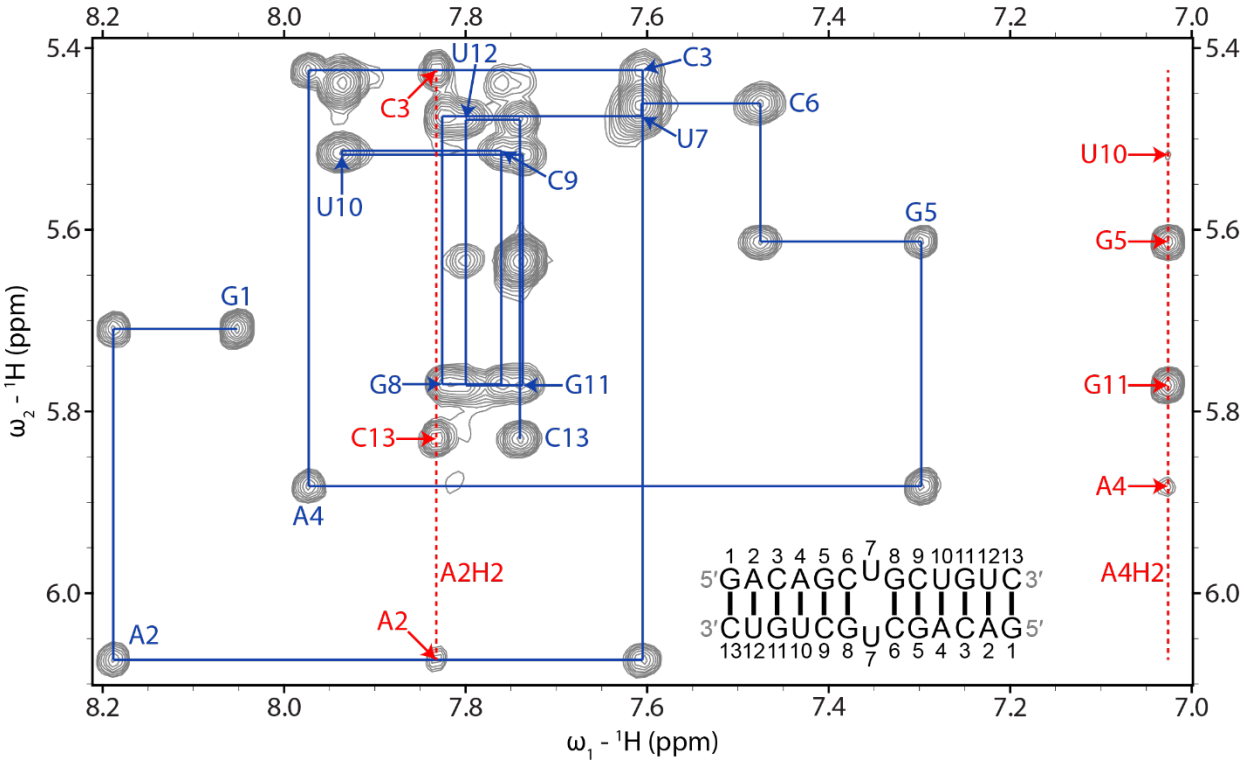

Figure S2: H6/H8-H1′ region of a 2D ^{1}H NOESY spectrum of unbound r(CUG). Blue lines represent a sequential H6/H8-H1′ walk, and blue labels represent intraresidue H6/H8 to H1′ NOEs. Dashed red lines represent adenine H2 resonances, and red labels represent interresidue and intraresidue NOEs between adenine H2 and H1′ of nearby residues. The spectrum was acquired at 25 °C with 400 ms mixing time and 0.3 mM of RNA.

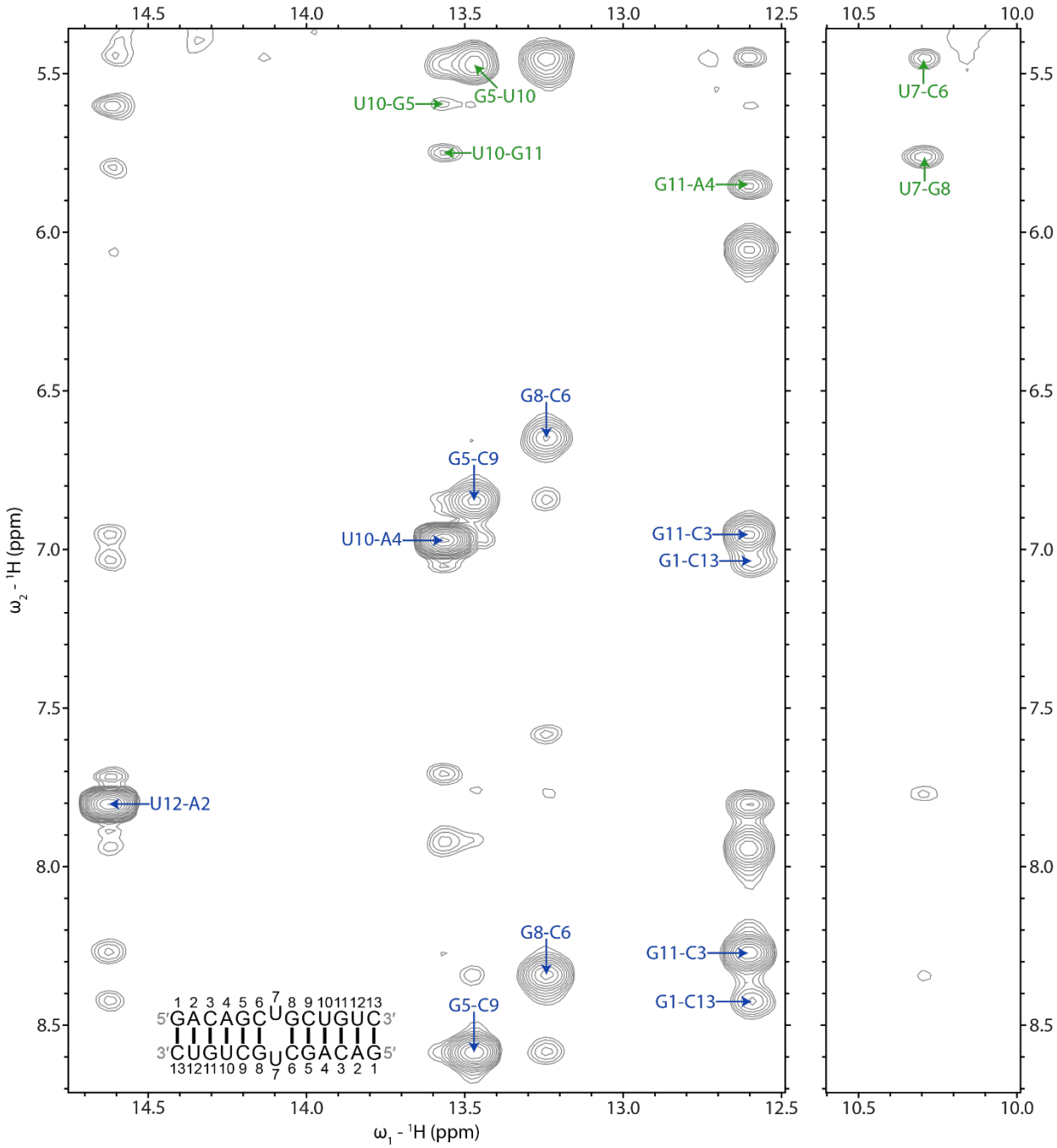

Figure S3: Imino proton region of a 2D ^{1}H NOESY spectrum of unbound r(CUG). Blue labels represent UH3-AH2 and GH1 to C amino NOEs within base pairs. Green labels represent NOEs between UH3 or GH1 and the H1′ of a 3′ adjacent or cross-strand residue. In each label, the first residue is UH3 or GH1 and the second label is adenine H2, a cytosine amino proton, or H1′ of any residue. The spectrum was acquired at 5 °C with 125 ms mixing time and 0.3 mM of RNA.

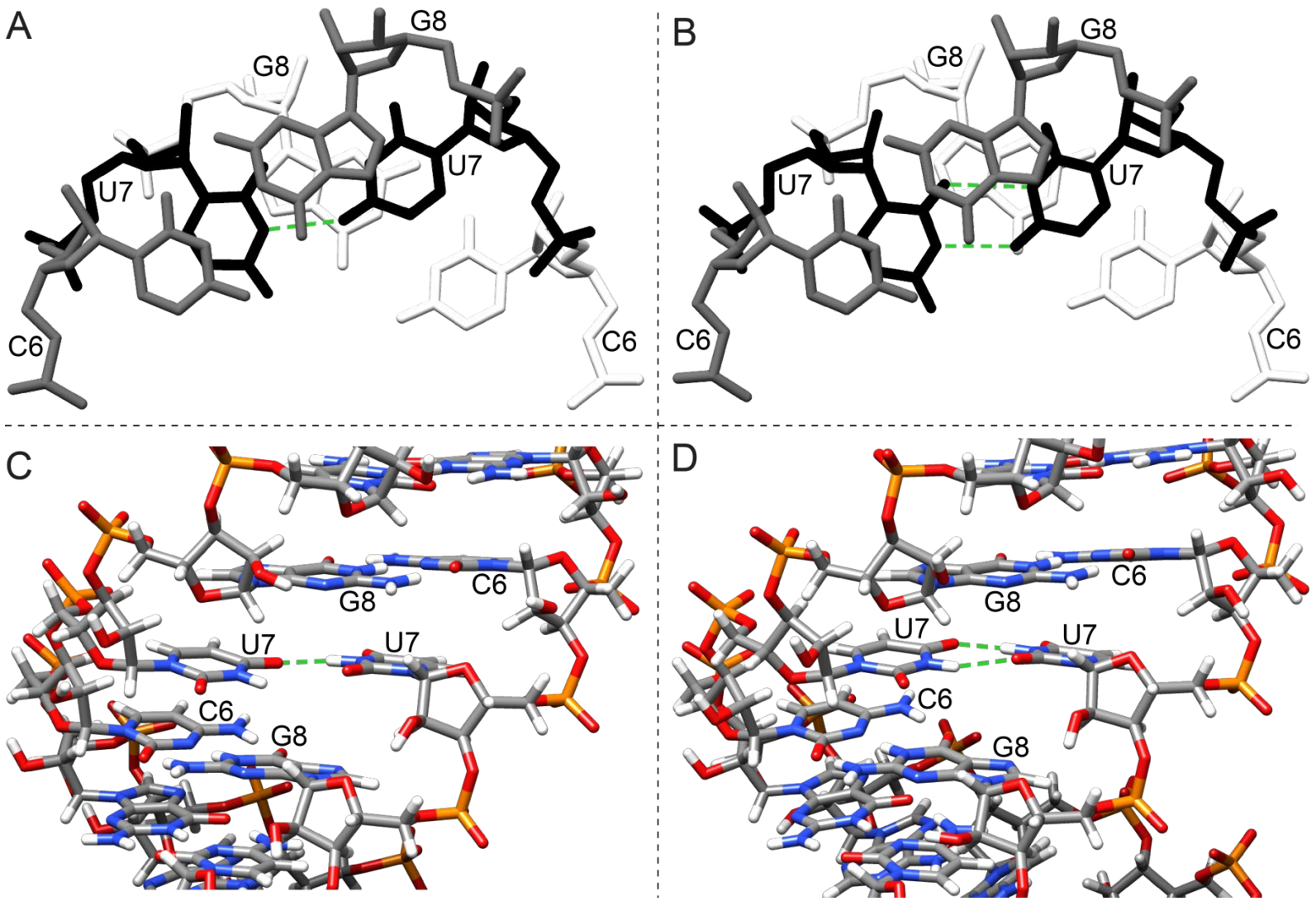

Figure S4: Structures of the unbound r(CUG) motif (5'CUG/3'GUC). (A) Major groove view showing overtwisting and undertwisting of the helix at the r(CUG) motif containing one and two hydrogen bond UU pairs where the UU pairs are colored black. (B) Minor groove view showing the stacking of one and two hydrogen bond UU pairs in the helix. Hydrogen bonds in the UU pairs are shown with green dashed lines.

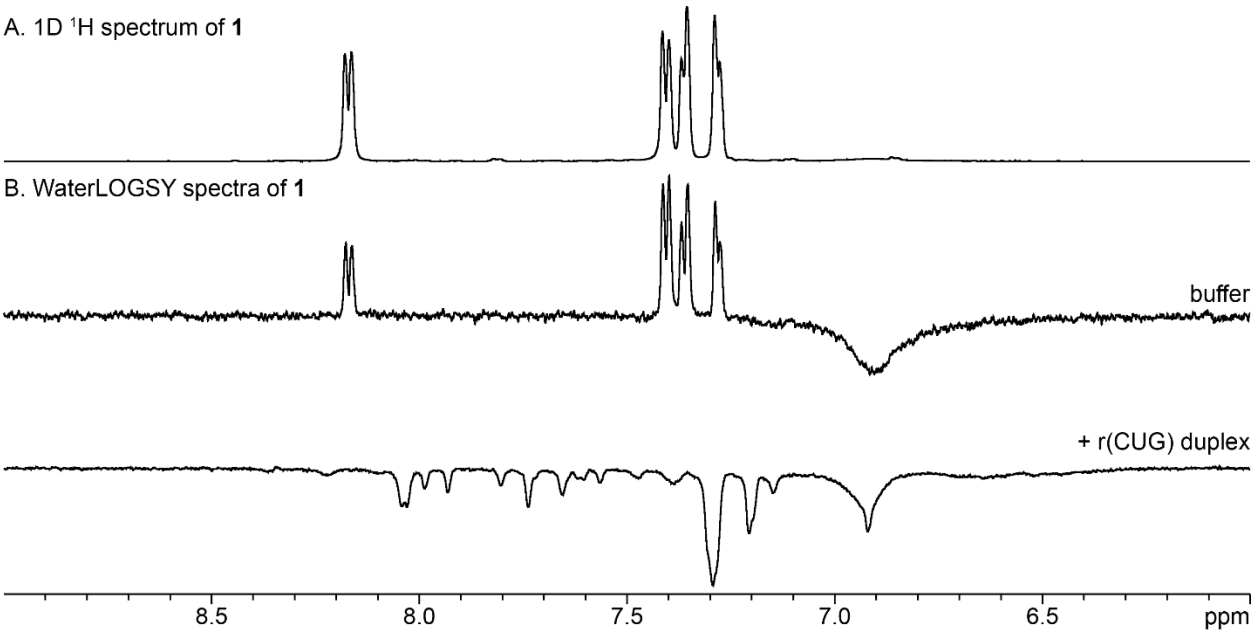

Figure S5: 1D ^{1}H and WaterLOGSY NMR spectra of 1 alone and in complex with the model r(CUG) duplex. (A) 1D ^{1}H NMR spectrum of 300 μM of **1**. (B) WaterLOGSY spectra of 300 μM of **1** in buffer alone or with 10 μM of the model r(CUG) duplex. Spectra were acquired at 25 °C.

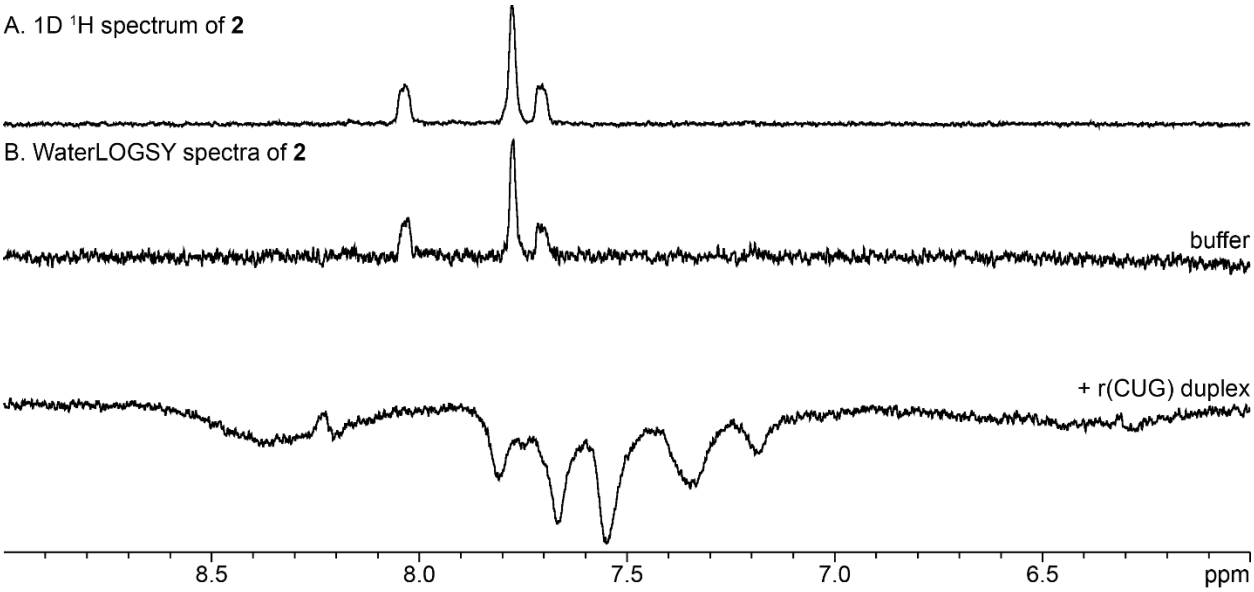

Figure S6: 1D ^{1}H and WaterLOGSY NMR spectra of 2 alone and in complex with the r(CUG) duplex. (A) 1D ^{1}H NMR spectrum of 300 μM of **2**. (B) WaterLOGSY spectra of 300 μM of **2** in buffer alone or with 10 μM of the model r(CUG) duplex. Spectra were acquired at 25 °C.

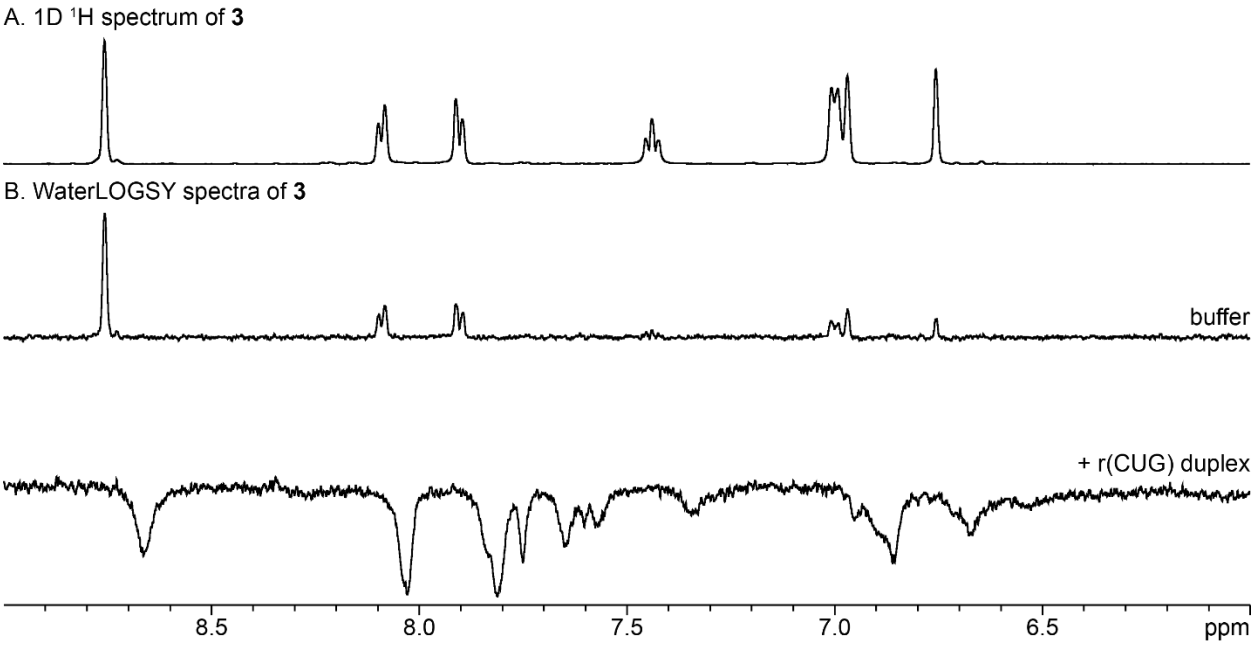

Figure S7: 1D ^{1}H and WaterLOGSY NMR spectra of 3 alone and in complex with the model r(CUG) duplex. (A) 1D 1H NMR spectrum of 300 μM of **3**. (B) WaterLOGSY spectra of 300 μM of **3** in buffer alone or with 10 μM of the model r(CUG) duplex. Spectra were acquired at 25 °C.

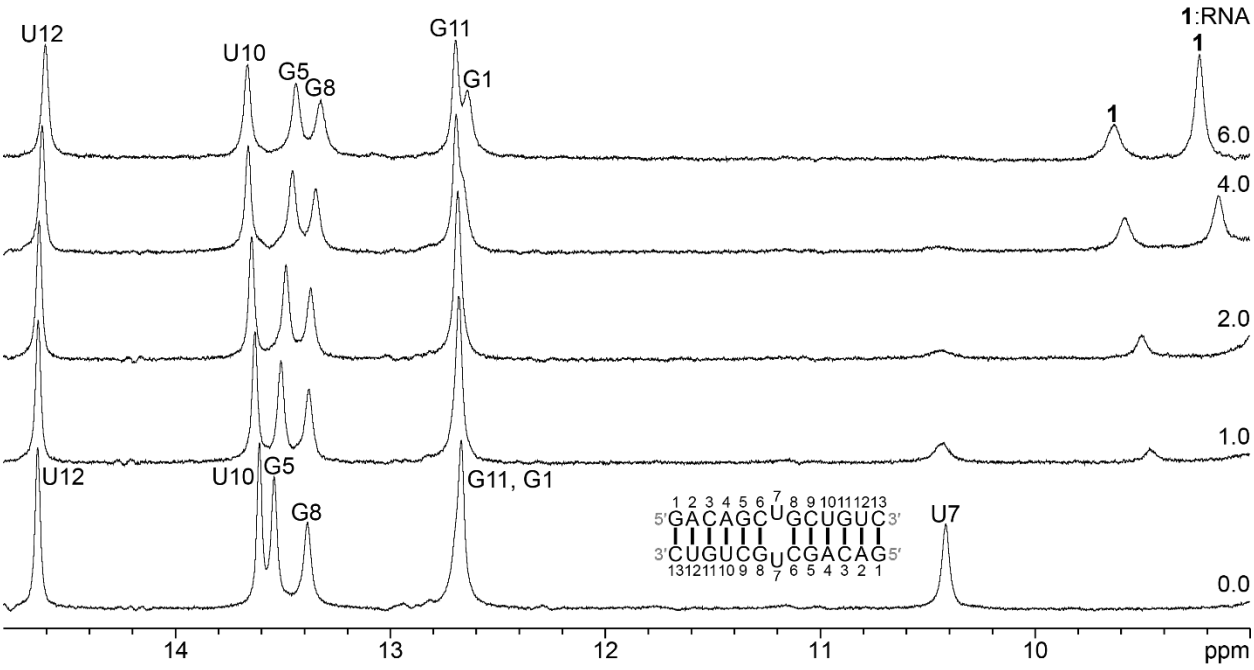

Figure S8: 1D ^{1}H imino region of the model r(CUG) duplex upon titration of 1. The molar ratio of **1**:r(CUG) RNA is on the right. Spectra were acquired at 5 °C with 50 μM of RNA and 0 to 300 μM of **1**.

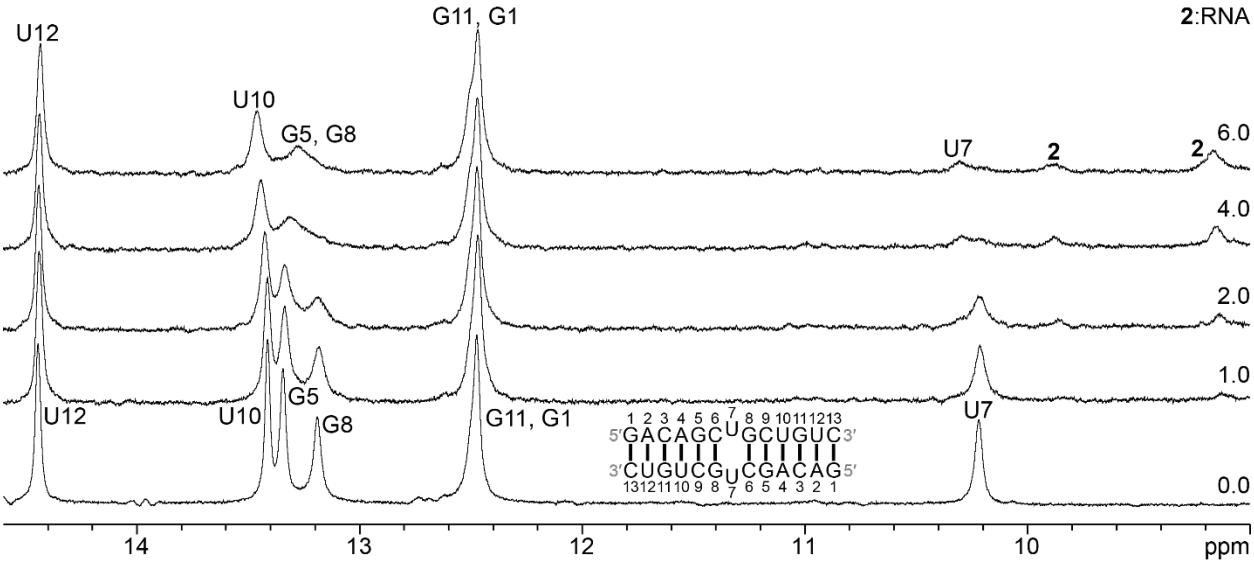

Figure S9: 1D 1H imino region of the model r(CUG) duplex upon titration of 2. The molar ratio of **2**:r(CUG) RNA is indicated on the right. Spectra were acquired at 5 °C with 50 μM of RNA and 0 to 300 μM of **2**.

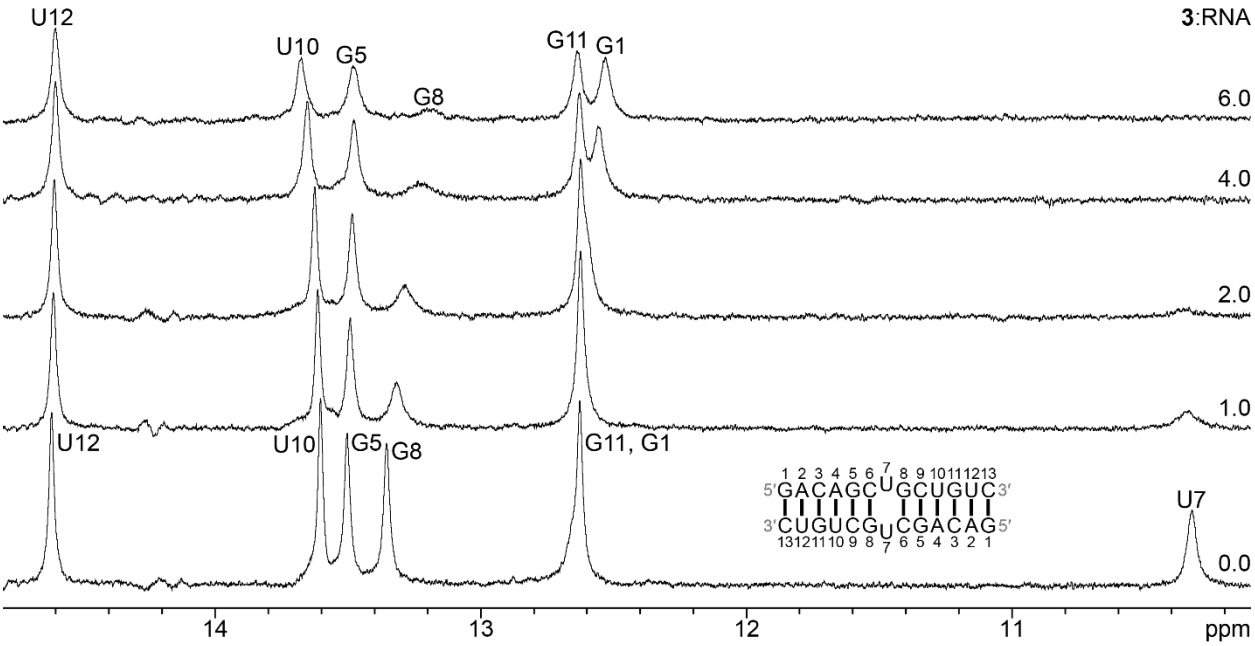

Figure S10: 1D 1H imino region of the model r(CUG) duplex upon titration of 3. The molar ratio of **3**:r(CUG) RNA is indicated on the right. Spectra were acquired at 5 °C with 50 μM of RNA and 0 to 300 μM of **3**.

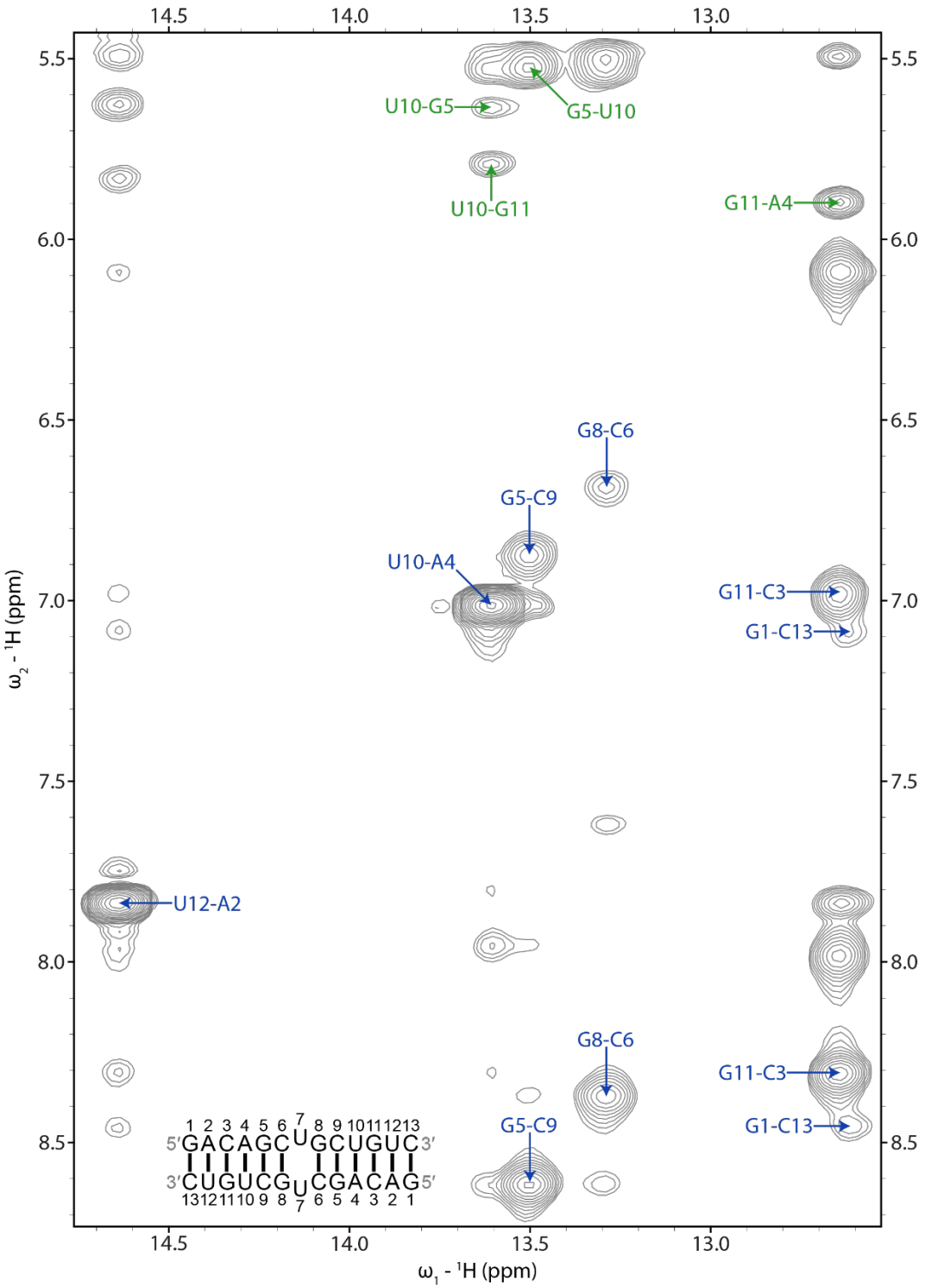

Figure S11: Imino proton region of a 2D ^{1}H NOESY spectrum of the r(CUG)-1 complex. Blue labels represent UH3-AH2 and GH1 to C amino NOEs within base pairs. Green labels represent NOEs between UH3 or GH1 and the H1′ of a 3′ adjacent or cross-strand residue. In each label, the first residue is UH3 or GH1 and the second label is adenine H2, a cytosine amino proton, or H1′ of any residue. The spectrum was acquired at 6 °C with 125 ms mixing time and 0.3 mM of RNA and 0.6 mM of **1**.

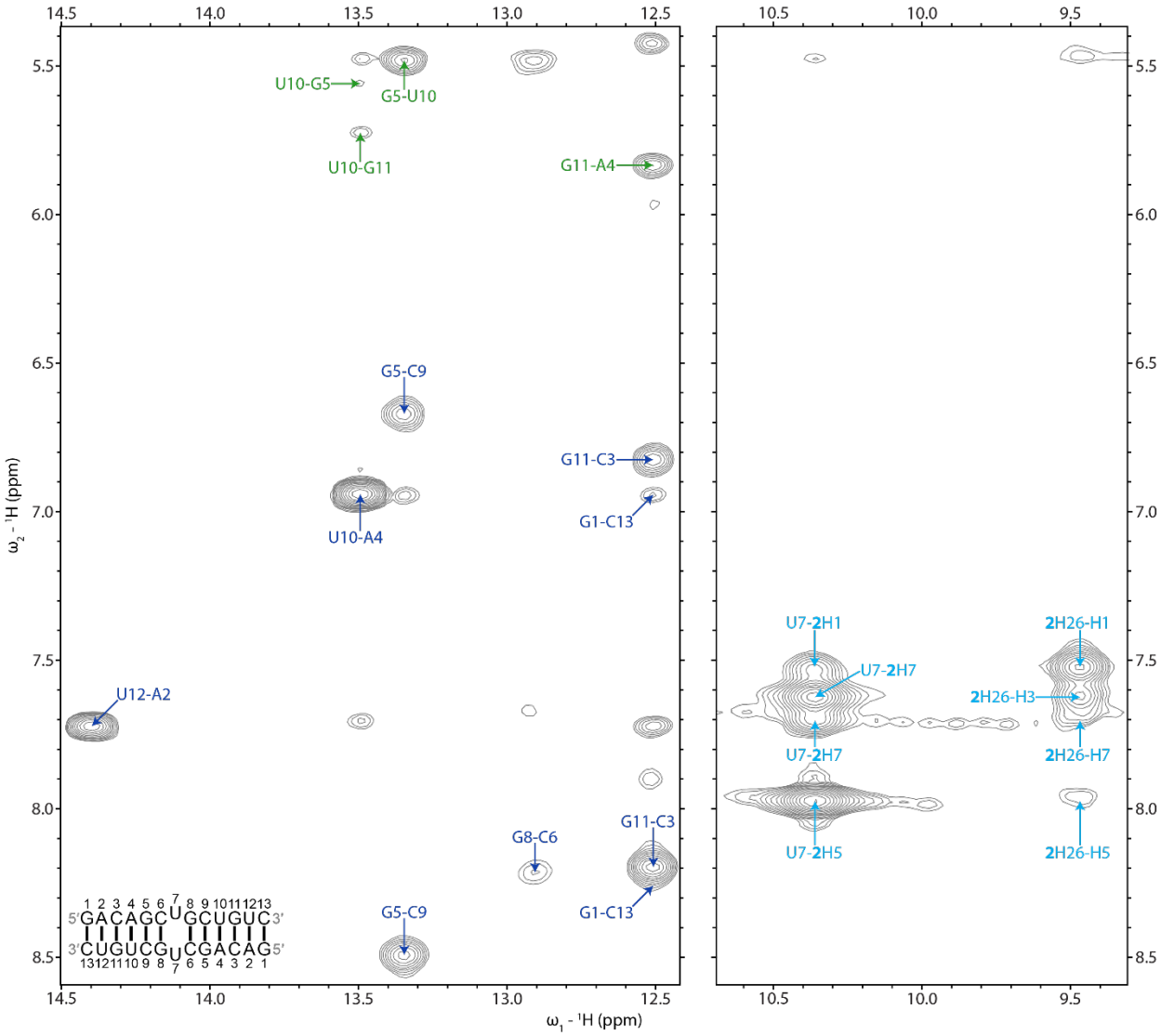

Figure S12: Imino proton region of a 2D ^{1}H NOESY spectrum of the r(CUG)-2 complex. Blue labels represent UH3-AH2 and GH1 to C amino NOEs within base pairs. Green labels represent NOEs between UH3 or GH1 and the H1′ of a 3′ adjacent or cross-strand residue. In each label, the first residue is UH3 or GH1 and the second label is adenine H2, a cytosine amino proton, or H1′ of any residue. Light blue labels represent NOEs between exchangeable U7H3 or **2**-H26 protons and nonexchangeable protons of **2**. The spectrum was acquired at 15 °C with 125 ms mixing time and 0.3 mM of RNA and 0.6 mM of **2**.

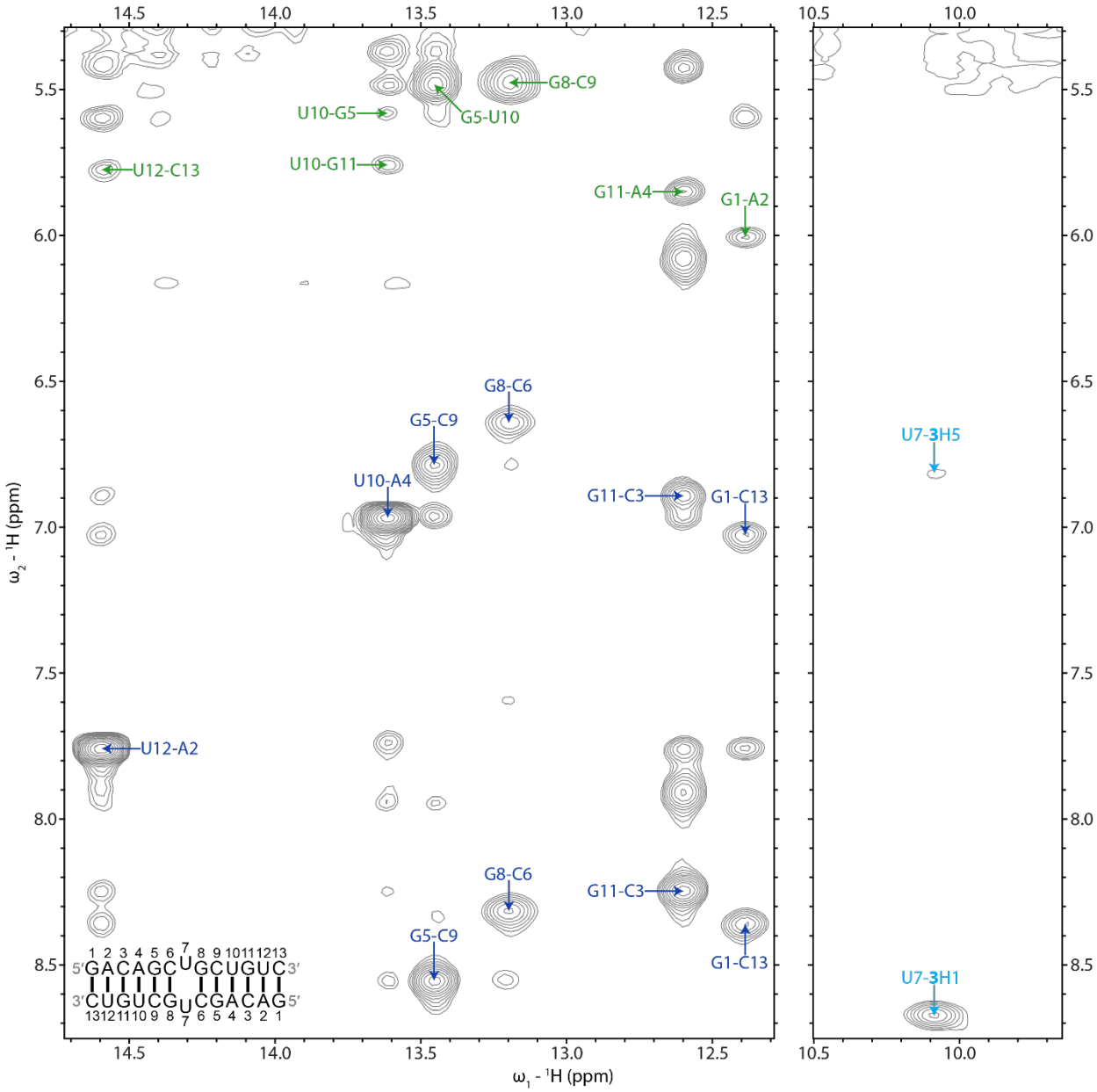

Figure S13: Imino proton region of a 2D ^{1}H NOESY spectrum of the r(CUG)-3 complex. Blue labels represent UH3-AH2 and GH1 to C amino NOEs within base pairs. Green labels represent NOEs between UH3 or GH1 and the H1′ of a 3′ adjacent or cross-strand residue. In each label, the first residue is UH3 or GH1 and the second label is adenine H2, a cytosine amino proton, or H1′ of any residue. Light blue labels represent NOEs between U7H3 and **3**-H5 or -H1. The spectrum was acquired at 5 °C with 125 ms mixing time and 0.4 mM of RNA and 0.6 mM of **3**.

Table S1: Physicochemical properties of **1**, **2**, and **3**. Abbreviations are defined as follows: MW, molecular weight; NHAT, number of heavy atoms; NAHA, number of aromatic heavy atoms; Nrot, number of rotatable bonds; NHA, number of hydrogen bond acceptors; NHB, number of hydrogen bond donors; MF, molar refractivity; TPSA, topological polar surface area; PAINS, pan-assay interference compounds; DL, druglikeness as defined by Lipinski's Rule of 5;[2] QED: quantitative estimate of druglikeness.

Compound	MW (g/mol)	NHAT	NAHA	Fraction C sp^3	Nrot	NHA	NHB	MF	TPSA ($Å^2$)	PAINS alert	DL (Lipinski)	QED
1	314.34	23	12	0.0	7	2	6	90.98	154.44	0	Yes	0.22
2	381.49	28	12	0.38	7	5	5	125.83	71.67	0	Yes	0.52
3	309.39	23	12	0.17	4	1	4	95.41	89.09	0	Yes	0.50

Table S2: NOE restraints used for modeling of the unbound r(CUG) duplex.

1	G	H1	26	C	N3	1.8	2.4
1	G	H1'	1	G	H2'	2.17	3.45
1	G	H1'	1	G	H3'	3.09	4.93
1	G	H22	26	C	O2	1.8	2.4
1	G	H8	1	G	H1'	2.61	4.16
1	G	H8	1	G	H2'	2.48	3.96
1	G	H8	1	G	H3'	2.32	3.7
1	G	O6	26	C	H41	1.8	2.4
2	A	H1'	1	G	H2'	3.55	5.66
2	A	H1'	2	A	H2'	2.15	3.43
2	A	H2	2	A	H1'	3	6
2	A	H2	3	C	H1'	2.71	4.32
2	A	H2	26	C	H1'	2.88	4.59
2	A	H61	25	U	O4	1.8	2.4
2	A	H8	1	G	H2'	2.09	3.33
2	A	H8	1	G	H3'	2.28	3.64
2	A	H8	2	A	H1'	3	4.79
2	A	H8	2	A	H2'	3.25	5.18
2	A	H8	3	C	H5	3	6
2	A	N1	25	U	H3	1.8	2.4
3	C	H1'	3	C	H2'	2.2	3.5
3	C	H2'	3	C	H5	3	6
3	C	H41	24	G	O6	1.8	2.4
3	C	H6	3	C	H1'	2.68	4.27
3	C	H6	3	C	H2'	1.8	4.5
3	C	N3	24	G	H1	1.8	2.4
3	C	O2	24	G	H22	1.8	2.4
4	A	H1'	3	C	H2'	3.7	5.91
4	A	H1'	4	A	H2'	2.17	3.45
4	A	H2	4	A	H1'	3	6
4	A	H2	5	G	H1'	2.84	4.52
4	A	H2	23	U	H1'	3	6
4	A	H2	24	G	H1'	2.65	4.22
4	A	H2'	5	G	H1'	3.47	5.53
4	A	H61	23	U	O4	1.8	2.4
4	A	H8	3	C	H2'	1.86	2.97
4	A	H8	3	C	H3'	2.28	3.64
4	A	H8	3	C	H5	3	6
4	A	H8	4	A	H1'	3.44	5.48
4	A	H8	4	A	H2'	2.51	4.01
4	A	N1	23	U	H3	1.8	2.4
5	G	H1	22	C	N3	1.8	2.4
5	G	H1'	5	G	H2'	2.1	3.35
5	G	H1'	5	G	H3'	2.95	4.7
5	G	H2'	6	C	H5	2.65	4.23
5	G	H22	22	C	O2	1.8	2.4
5	G	H3'	6	C	H5	2.72	4.35
5	G	H8	4	A	H2'	1.97	3.14

5	G	H8	5	G	H1'	3.11	4.95
5	G	H8	5	G	H2'	3.26	5.2
5	G	H8	5	G	H3'	2.2	3.5
5	G	H8	6	C	H5	3	6
5	G	O6	22	C	H41	1.8	2.4
6	C	H2'	6	C	H5	3.27	5.22
6	C	H41	21	G	O6	1.8	2.4
6	C	H6	5	G	H2'	1.79	2.85
6	C	H6	5	G	H3'	1.8	4.5
6	C	H6	6	C	H1'	2.63	4.19
6	C	H6	6	C	H2'	1.8	4.5
6	C	N3	21	G	H1	1.8	2.4
6	C	O2	21	G	H22	1.8	2.4
7	U	H3	8	G	H1'	3	7
7	U	H3	21	G	H1'	3	7
7	U	H6	6	C	H2'	1.8	3
7	U	H6	6	C	H5	3	6
7	U	H6	6	C	H6	3	6
8	G	H1	19	C	N3	1.8	2.4
8	G	H1'	7	U	H2'	3.21	5.12
8	G	H1'	8	G	H2'	2.13	3.4
8	G	H2'	9	C	H5	2.62	4.17
8	G	H22	19	C	O2	1.8	2.4
8	G	H3'	9	C	H5	3.22	5.14
8	G	H8	7	U	H1'	3	6
8	G	H8	7	U	H2'	1.89	3.01
8	G	H8	7	U	H6	3	6
8	G	H8	8	G	H1'	3.09	4.93
8	G	H8	8	G	H2'	2.79	4.45
8	G	H8	8	G	H3'	2.08	3.31
8	G	H8	9	C	H5	3.55	5.66
8	G	O6	19	C	H41	1.8	2.4
9	C	H1'	9	C	H3'	2.4	3.83
9	C	H2'	9	C	H5	3	6
9	C	H3'	9	C	H5	2.98	4.75
9	C	H41	18	G	O6	1.8	2.4
9	C	H6	8	G	H2'	1.88	3
9	C	H6	9	C	H1'	2.75	4.38
9	C	H6	9	C	H2'	2.66	4.25
9	C	H6	9	C	H3'	1.89	3.01
9	C	H6	10	U	H5	3.32	5.29
9	C	N3	18	G	H1	1.8	2.4
9	C	O2	18	G	H22	1.8	2.4
10	U	H1'	10	U	H2'	2.31	3.68
10	U	H1'	10	U	H3'	2.69	4.28
10	U	H2'	10	U	H5	3	6
10	U	H3	17	A	N1	1.8	2.4
10	U	H3'	10	U	H5	3	6
10	U	H6	9	C	H2'	1.76	2.81
10	U	H6	9	C	H3'	2.17	3.46
10	U	H6	9	C	H5	3	6

10	U	H6	10	U	H2'	2.79	4.45
10	U	H6	10	U	H3'	1.93	3.09
10	U	O4	17	A	H61	1.8	2.4
11	G	H1	16	C	N3	1.8	2.4
11	G	H1'	11	G	H2'	2.04	3.25
11	G	H1'	11	G	H3'	2.66	4.25
11	G	H2'	12	U	H5	2.5	3.99
11	G	H22	16	C	O2	1.8	2.4
11	G	H3'	12	U	H5	2.65	4.22
11	G	H8	10	U	H2'	1.88	3
11	G	H8	11	G	H1'	2.86	4.56
11	G	H8	11	G	H3'	2.11	3.37
11	G	H8	12	U	H5	3.56	5.67
11	G	O6	16	C	H41	1.8	2.4
12	U	H1'	12	U	H2'	1.98	3.15
12	U	H1'	12	U	H3'	2.66	4.25
12	U	H2'	12	U	H5	3	6
12	U	H3	15	A	N1	1.8	2.4
12	U	H3'	12	U	H5	3.05	4.86
12	U	H6	11	G	H2'	1.67	2.66
12	U	H6	11	G	H3'	2.12	3.39
12	U	H6	12	U	H1'	2.53	4.03
12	U	H6	12	U	H2'	2.55	4.07
12	U	H6	12	U	H3'	1.91	3.05
12	U	H6	13	C	H5	3.19	5.09
12	U	O4	15	A	H61	1.8	2.4
13	C	H1'	13	C	H2'	2.01	3.2
13	C	H1'	13	C	H3'	2.65	4.23
13	C	H2'	13	C	H5	3	6
13	C	H3'	13	C	H5	3.03	4.83
13	C	H41	14	G	O6	1.8	2.4
13	C	H5	12	U	H2'	2.8	4.46
13	C	H5	12	U	H3'	3.03	4.84
13	C	H6	12	U	H2'	1.84	2.94
13	C	H6	12	U	H3'	2.2	3.52
13	C	H6	13	C	H1'	2.56	4.08
13	C	H6	13	C	H2'	2.28	3.63
13	C	H6	13	C	H3'	1.85	2.95
13	C	N3	14	G	H1	1.8	2.4
13	C	O2	14	G	H22	1.8	2.4
14	G	H1'	14	G	H2'	2.17	3.45
14	G	H1'	14	G	H3'	3.09	4.93
14	G	H8	14	G	H1'	2.61	4.16
14	G	H8	14	G	H2'	2.48	3.96
14	G	H8	14	G	H3'	2.32	3.7
15	A	H1'	14	G	H2'	3.55	5.66
15	A	H1'	15	A	H2'	2.15	3.43
15	A	H2	13	C	H1'	2.88	4.59
15	A	H2	15	A	H1'	3	6
15	A	H2	16	C	H1'	2.71	4.32
15	A	H8	14	G	H2'	2.09	3.33

15	A	H8	14	G	H3'	2.28	3.64
15	A	H8	15	A	H1'	3	4.79
15	A	H8	15	A	H2'	3.25	5.18
15	A	H8	16	C	H5	3	6
16	C	H1'	16	C	H2'	2.2	3.5
16	C	H2'	16	C	H5	3	6
16	C	H6	16	C	H1'	2.68	4.27
16	C	H6	16	C	H2'	1.8	4.5
17	A	H1'	16	C	H2'	3.7	5.91
17	A	H1'	17	A	H2'	2.17	3.45
17	A	H2	10	U	H1'	3	6
17	A	H2	11	G	H1'	2.65	4.22
17	A	H2	17	A	H1'	3	6
17	A	H2	18	G	H1'	2.84	4.52
17	A	H2'	18	G	H1'	3.47	5.53
17	A	H8	16	C	H2'	1.86	2.97
17	A	H8	16	C	H3'	2.28	3.64
17	A	H8	16	C	H5	3	6
17	A	H8	17	A	H1'	3.44	5.48
17	A	H8	17	A	H2'	2.51	4.01
18	G	H1'	18	G	H2'	2.1	3.35
18	G	H1'	18	G	H3'	2.95	4.7
18	G	H2'	19	C	H5	2.65	4.23
18	G	H3'	19	C	H5	2.72	4.35
18	G	H8	17	A	H2'	1.97	3.14
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18	G	H8	18	G	H2'	3.26	5.2
18	G	H8	18	G	H3'	2.2	3.5
18	G	H8	19	C	H5	3	6
19	C	H2'	19	C	H5	3.27	5.22
19	C	H6	18	G	H2'	1.79	2.85
19	C	H6	18	G	H3'	1.8	4.5
19	C	H6	19	C	H1'	2.63	4.19
19	C	H6	19	C	H2'	1.8	4.5
20	U	H3	8	G	H1'	3	7
20	U	H3	21	G	H1'	3	7
20	U	H6	19	C	H2'	1.8	3
20	U	H6	19	C	H5	3	6
20	U	H6	19	C	H6	3	6
21	G	H1'	20	U	H2'	3.21	5.12
21	G	H1'	21	G	H2'	2.13	3.4
21	G	H2'	22	C	H5	2.62	4.17
21	G	H3'	22	C	H5	3.22	5.14
21	G	H8	20	U	H1'	3	6
21	G	H8	20	U	H2'	1.89	3.01
21	G	H8	20	U	H6	3	6
21	G	H8	21	G	H1'	3.09	4.93
21	G	H8	21	G	H2'	2.79	4.45
21	G	H8	21	G	H3'	2.08	3.31
21	G	H8	22	C	H5	3.55	5.66
22	C	H1'	22	C	H3'	2.4	3.83

22	C	H2'	22	C	H5	3	6
22	C	H3'	22	C	H5	2.98	4.75
22	C	H6	21	G	H2'	1.88	3
22	C	H6	22	C	H1'	2.75	4.38
22	C	H6	22	C	H2'	2.66	4.25
22	C	H6	22	C	H3'	1.89	3.01
22	C	H6	23	U	H5	3.32	5.29
23	U	H1'	23	U	H2'	2.31	3.68
23	U	H1'	23	U	H3'	2.69	4.28
23	U	H2'	23	U	H5	3	6
23	U	H3'	23	U	H5	3	6
23	U	H6	22	C	H2'	1.76	2.81
23	U	H6	22	C	H3'	2.17	3.46
23	U	H6	22	C	H5	3	6
23	U	H6	23	U	H2'	2.79	4.45
23	U	H6	23	U	H3'	1.93	3.09
24	G	H1'	24	G	H2'	2.04	3.25
24	G	H1'	24	G	H3'	2.66	4.25
24	G	H2'	25	U	H5	2.5	3.99
24	G	H3'	25	U	H5	2.65	4.22
24	G	H8	23	U	H2'	1.88	3
24	G	H8	24	G	H1'	2.86	4.56
24	G	H8	24	G	H3'	2.11	3.37
24	G	H8	25	U	H5	3.56	5.67
25	U	H1'	25	U	H2'	1.98	3.15
25	U	H1'	25	U	H3'	2.66	4.25
25	U	H2'	25	U	H5	3	6
25	U	H3'	25	U	H5	3.05	4.86
25	U	H6	24	G	H2'	1.67	2.66
25	U	H6	24	G	H3'	2.12	3.39
25	U	H6	25	U	H1'	2.53	4.03
25	U	H6	25	U	H2'	2.55	4.07
25	U	H6	25	U	H3'	1.91	3.05
25	U	H6	26	C	H5	3.19	5.09
26	C	H1'	26	C	H2'	2.01	3.2
26	C	H1'	26	C	H3'	2.65	4.23
26	C	H2'	26	C	H5	3	6
26	C	H3'	26	C	H5	3.03	4.83
26	C	H5	25	U	H2'	2.8	4.46
26	C	H5	25	U	H3'	3.03	4.84
26	C	H6	25	U	H2'	1.84	2.94
26	C	H6	25	U	H3'	2.2	3.52
26	C	H6	26	C	H1'	2.56	4.08
26	C	H6	26	C	H2'	2.28	3.63
26	C	H6	26	C	H3'	1.85	2.95

Table S3: Dihedral restraints used for modeling of the unbound r(CUG) duplex.

ALPHA	(1 RG5 O3')-(2 RA P)-(2 RA O5')-(2 RA C5')	-155.0	25.0
ALPHA	(2 RA O3')-(3 RC P)-(3 RC O5')-(3 RC C5')	-155.0	25.0
ALPHA	(3 RC O3')-(4 RA P)-(4 RA O5')-(4 RA C5')	-155.0	25.0
ALPHA	(4 RA O3')-(5 RG P)-(5 RG O5')-(5 RG C5')	-155.0	25.0
ALPHA	(5 RG O3')-(6 RC P)-(6 RC O5')-(6 RC C5')	-155.0	25.0
ALPHA	(7 RU O3')-(8 RG P)-(8 RG O5')-(8 RG C5')	-155.0	25.0
ALPHA	(8 RG O3')-(9 RC P)-(9 RC O5')-(9 RC C5')	-155.0	25.0
ALPHA	(9 RC O3')-(10 RU P)-(10 RU O5')-(10 RU C5')	-155.0	25.0
ALPHA	(10 RU O3')-(11 RG P)-(11 RG O5')-(11 RG C5')	-155.0	25.0
ALPHA	(11 RG O3')-(12 RU P)-(12 RU O5')-(12 RU C5')	-155.0	25.0
ALPHA	(14 RG5 O3')-(15 RA P)-(15 RA O5')-(15 RA C5')	-155.0	25.0
ALPHA	(15 RA O3')-(16 RC P)-(16 RC O5')-(16 RC C5')	-155.0	25.0
ALPHA	(16 RC O3')-(17 RA P)-(17 RA O5')-(17 RA C5')	-155.0	25.0
ALPHA	(17 RA O3')-(18 RG P)-(18 RG O5')-(18 RG C5')	-155.0	25.0
ALPHA	(18 RG O3')-(19 RC P)-(19 RC O5')-(19 RC C5')	-155.0	25.0
ALPHA	(20 RU O3')-(21 RG P)-(21 RG O5')-(21 RG C5')	-155.0	25.0
ALPHA	(21 RG O3')-(22 RC P)-(22 RC O5')-(22 RC C5')	-155.0	25.0
ALPHA	(22 RC O3')-(23 RU P)-(23 RU O5')-(23 RU C5')	-155.0	25.0
ALPHA	(23 RU O3')-(24 RG P)-(24 RG O5')-(24 RG C5')	-155.0	25.0
ALPHA	(24 RG O3')-(25 RU P)-(25 RU O5')-(25 RU C5')	-155.0	25.0
BETA	(2 RA P)-(2 RA O5')-(2 RA C5')-(2 RA C4')	90.0	240.0
BETA	(3 RC P)-(3 RC O5')-(3 RC C5')-(3 RC C4')	90.0	240.0
BETA	(4 RA P)-(4 RA O5')-(4 RA C5')-(4 RA C4')	90.0	240.0
BETA	(5 RG P)-(5 RG O5')-(5 RG C5')-(5 RG C4')	90.0	240.0
BETA	(6 RC P)-(6 RC O5')-(6 RC C5')-(6 RC C4')	90.0	240.0
BETA	(8 RG P)-(8 RG O5')-(8 RG C5')-(8 RG C4')	90.0	240.0
BETA	(9 RC P)-(9 RC O5')-(9 RC C5')-(9 RC C4')	90.0	240.0
BETA	(10 RU P)-(10 RU O5')-(10 RU C5')-(10 RU C4')	90.0	240.0
BETA	(11 RG P)-(11 RG O5')-(11 RG C5')-(11 RG C4')	90.0	240.0
BETA	(12 RU P)-(12 RU O5')-(12 RU C5')-(12 RU C4')	90.0	240.0
BETA	(15 RA P)-(15 RA O5')-(15 RA C5')-(15 RA C4')	90.0	240.0
BETA	(16 RC P)-(16 RC O5')-(16 RC C5')-(16 RC C4')	90.0	240.0
BETA	(17 RA P)-(17 RA O5')-(17 RA C5')-(17 RA C4')	90.0	240.0
BETA	(18 RG P)-(18 RG O5')-(18 RG C5')-(18 RG C4')	90.0	240.0
BETA	(19 RC P)-(19 RC O5')-(19 RC C5')-(19 RC C4')	90.0	240.0
BETA	(21 RG P)-(21 RG O5')-(21 RG C5')-(21 RG C4')	90.0	240.0
BETA	(22 RC P)-(22 RC O5')-(22 RC C5')-(22 RC C4')	90.0	240.0
BETA	(23 RU P)-(23 RU O5')-(23 RU C5')-(23 RU C4')	90.0	240.0
BETA	(24 RG P)-(24 RG O5')-(24 RG C5')-(24 RG C4')	90.0	240.0
BETA	(25 RU P)-(25 RU O5')-(25 RU C5')-(25 RU C4')	90.0	240.0
GAMMA	(2 RA O5')-(2 RA C5')-(2 RA C4')-(2 RA C3')	0.0	120.0
GAMMA	(3 RC O5')-(3 RC C5')-(3 RC C4')-(3 RC C3')	0.0	120.0
GAMMA	(4 RA O5')-(4 RA C5')-(4 RA C4')-(4 RA C3')	0.0	120.0
GAMMA	(5 RG O5')-(5 RG C5')-(5 RG C4')-(5 RG C3')	0.0	120.0
GAMMA	(6 RC O5')-(6 RC C5')-(6 RC C4')-(6 RC C3')	0.0	120.0
GAMMA	(8 RG O5')-(8 RG C5')-(8 RG C4')-(8 RG C3')	0.0	120.0
GAMMA	(9 RC O5')-(9 RC C5')-(9 RC C4')-(9 RC C3')	0.0	120.0
GAMMA	(10 RU O5')-(10 RU C5')-(10 RU C4')-(10 RU C3')	0.0	120.0
GAMMA	(11 RG O5')-(11 RG C5')-(11 RG C4')-(11 RG C3')	0.0	120.0

GAMMA	(12 RU O5')-(12 RU C5')-(12 RU C4')-(12 RU C3')	0.0	120.0
GAMMA	(15 RA O5')-(15 RA C5')-(15 RA C4')-(15 RA C3')	0.0	120.0
GAMMA	(16 RC O5')-(16 RC C5')-(16 RC C4')-(16 RC C3')	0.0	120.0
GAMMA	(17 RA O5')-(17 RA C5')-(17 RA C4')-(17 RA C3')	0.0	120.0
GAMMA	(18 RG O5')-(18 RG C5')-(18 RG C4')-(18 RG C3')	0.0	120.0
GAMMA	(19 RC O5')-(19 RC C5')-(19 RC C4')-(19 RC C3')	0.0	120.0
GAMMA	(21 RG O5')-(21 RG C5')-(21 RG C4')-(21 RG C3')	0.0	120.0
GAMMA	(22 RC O5')-(22 RC C5')-(22 RC C4')-(22 RC C3')	0.0	120.0
GAMMA	(23 RU O5')-(23 RU C5')-(23 RU C4')-(23 RU C3')	0.0	120.0
GAMMA	(24 RG O5')-(24 RG C5')-(24 RG C4')-(24 RG C3')	0.0	120.0
GAMMA	(25 RU O5')-(25 RU C5')-(25 RU C4')-(25 RU C3')	0.0	120.0
DELTA	(2 RA C5')-(2 RA C4')-(2 RA C3')-(2 RA O3')	45.0	115.0
DELTA	(3 RC C5')-(3 RC C4')-(3 RC C3')-(3 RC O3')	45.0	115.0
DELTA	(4 RA C5')-(4 RA C4')-(4 RA C3')-(4 RA O3')	45.0	115.0
DELTA	(5 RG C5')-(5 RG C4')-(5 RG C3')-(5 RG O3')	45.0	115.0
DELTA	(6 RC C5')-(6 RC C4')-(6 RC C3')-(6 RC O3')	45.0	115.0
DELTA	(8 RG C5')-(8 RG C4')-(8 RG C3')-(8 RG O3')	45.0	115.0
DELTA	(9 RC C5')-(9 RC C4')-(9 RC C3')-(9 RC O3')	45.0	115.0
DELTA	(10 RU C5')-(10 RU C4')-(10 RU C3')-(10 RU O3')	45.0	115.0
DELTA	(11 RG C5')-(11 RG C4')-(11 RG C3')-(11 RG O3')	45.0	115.0
DELTA	(12 RU C5')-(12 RU C4')-(12 RU C3')-(12 RU O3')	45.0	115.0
DELTA	(15 RA C5')-(15 RA C4')-(15 RA C3')-(15 RA O3')	45.0	115.0
DELTA	(16 RC C5')-(16 RC C4')-(16 RC C3')-(16 RC O3')	45.0	115.0
DELTA	(17 RA C5')-(17 RA C4')-(17 RA C3')-(17 RA O3')	45.0	115.0
DELTA	(18 RG C5')-(18 RG C4')-(18 RG C3')-(18 RG O3')	45.0	115.0
DELTA	(19 RC C5')-(19 RC C4')-(19 RC C3')-(19 RC O3')	45.0	115.0
DELTA	(21 RG C5')-(21 RG C4')-(21 RG C3')-(21 RG O3')	45.0	115.0
DELTA	(22 RC C5')-(22 RC C4')-(22 RC C3')-(22 RC O3')	45.0	115.0
DELTA	(23 RU C5')-(23 RU C4')-(23 RU C3')-(23 RU O3')	45.0	115.0
DELTA	(24 RG C5')-(24 RG C4')-(24 RG C3')-(24 RG O3')	45.0	115.0
DELTA	(25 RU C5')-(25 RU C4')-(25 RU C3')-(25 RU O3')	45.0	115.0
EPSILON	(2 RA C4')-(2 RA C3')-(2 RA O3')-(3 RC P)	-240.0	10.0
EPSILON	(3 RC C4')-(3 RC C3')-(3 RC O3')-(4 RA P)	-240.0	10.0
EPSILON	(4 RA C4')-(4 RA C3')-(4 RA O3')-(5 RG P)	-240.0	10.0
EPSILON	(5 RG C4')-(5 RG C3')-(5 RG O3')-(6 RC P)	-240.0	10.0
EPSILON	(6 RC C4')-(6 RC C3')-(6 RC O3')-(7 RU P)	-240.0	10.0
EPSILON	(8 RG C4')-(8 RG C3')-(8 RG O3')-(9 RC P)	-240.0	10.0
EPSILON	(9 RC C4')-(9 RC C3')-(9 RC O3')-(10 RU P)	-240.0	10.0
EPSILON	(10 RU C4')-(10 RU C3')-(10 RU O3')-(11 RG P)	-240.0	10.0
EPSILON	(11 RG C4')-(11 RG C3')-(11 RG O3')-(12 RU P)	-240.0	10.0
EPSILON	(12 RU C4')-(12 RU C3')-(12 RU O3')-(13 RC3 P)	-240.0	10.0
EPSILON	(15 RA C4')-(15 RA C3')-(15 RA O3')-(16 RC P)	-240.0	10.0
EPSILON	(16 RC C4')-(16 RC C3')-(16 RC O3')-(17 RA P)	-240.0	10.0
EPSILON	(17 RA C4')-(17 RA C3')-(17 RA O3')-(18 RG P)	-240.0	10.0
EPSILON	(18 RG C4')-(18 RG C3')-(18 RG O3')-(19 RC P)	-240.0	10.0
EPSILON	(19 RC C4')-(19 RC C3')-(19 RC O3')-(20 RU P)	-240.0	10.0
EPSILON	(21 RG C4')-(21 RG C3')-(21 RG O3')-(22 RC P)	-240.0	10.0
EPSILON	(22 RC C4')-(22 RC C3')-(22 RC O3')-(23 RU P)	-240.0	10.0
EPSILON	(23 RU C4')-(23 RU C3')-(23 RU O3')-(24 RG P)	-240.0	10.0
EPSILON	(24 RG C4')-(24 RG C3')-(24 RG O3')-(25 RU P)	-240.0	10.0
EPSILON	(25 RU C4')-(25 RU C3')-(25 RU O3')-(26 RC3 P)	-240.0	10.0

ZETA	(2 RA C3')-(2 RA O3')-(3 RC P)-(3 RC O5')	-160.0	20.0
ZETA	(3 RC C3')-(3 RC O3')-(4 RA P)-(4 RA O5')	-160.0	20.0
ZETA	(4 RA C3')-(4 RA O3')-(5 RG P)-(5 RG O5')	-160.0	20.0
ZETA	(5 RG C3')-(5 RG O3')-(6 RC P)-(6 RC O5')	-160.0	20.0
ZETA	(6 RC C3')-(6 RC O3')-(7 RU P)-(7 RU O5')	-160.0	20.0
ZETA	(8 RG C3')-(8 RG O3')-(9 RC P)-(9 RC O5')	-160.0	20.0
ZETA	(9 RC C3')-(9 RC O3')-(10 RU P)-(10 RU O5')	-160.0	20.0
ZETA	(10 RU C3')-(10 RU O3')-(11 RG P)-(11 RG O5')	-160.0	20.0
ZETA	(11 RG C3')-(11 RG O3')-(12 RU P)-(12 RU O5')	-160.0	20.0
ZETA	(12 RU C3')-(12 RU O3')-(13 RC3 P)-(13 RC3 O5')	-160.0	20.0
ZETA	(15 RA C3')-(15 RA O3')-(16 RC P)-(16 RC O5')	-160.0	20.0
ZETA	(16 RC C3')-(16 RC O3')-(17 RA P)-(17 RA O5')	-160.0	20.0
ZETA	(17 RA C3')-(17 RA O3')-(18 RG P)-(18 RG O5')	-160.0	20.0
ZETA	(18 RG C3')-(18 RG O3')-(19 RC P)-(19 RC O5')	-160.0	20.0
ZETA	(19 RC C3')-(19 RC O3')-(20 RU P)-(20 RU O5')	-160.0	20.0
ZETA	(21 RG C3')-(21 RG O3')-(22 RC P)-(22 RC O5')	-160.0	20.0
ZETA	(22 RC C3')-(22 RC O3')-(23 RU P)-(23 RU O5')	-160.0	20.0
ZETA	(23 RU C3')-(23 RU O3')-(24 RG P)-(24 RG O5')	-160.0	20.0
ZETA	(24 RG C3')-(24 RG O3')-(25 RU P)-(25 RU O5')	-160.0	20.0
ZETA	(25 RU C3')-(25 RU O3')-(26 RC3 P)-(26 RC3 O5')	-160.0	20.0
CHI	(2 RA O4')-(2 RA C1')-(2 RA N9)-(2 RA C4)	170.0	340.0
CHI	(3 RC O4')-(3 RC C1')-(3 RC N1)-(3 RC C2)	170.0	340.0
CHI	(4 RA O4')-(4 RA C1')-(4 RA N9)-(4 RA C4)	170.0	340.0
CHI	(5 RG O4')-(5 RG C1')-(5 RG N9)-(5 RG C4)	170.0	340.0
CHI	(6 RC O4')-(6 RC C1')-(6 RC N1)-(6 RC C2)	170.0	340.0
CHI	(8 RG O4')-(8 RG C1')-(8 RG N9)-(8 RG C4)	170.0	340.0
CHI	(9 RC O4')-(9 RC C1')-(9 RC N1)-(9 RC C2)	170.0	340.0
CHI	(10 RU O4')-(10 RU C1')-(10 RU N1)-(10 RU C2)	170.0	340.0
CHI	(11 RG O4')-(11 RG C1')-(11 RG N9)-(11 RG C4)	170.0	340.0
CHI	(12 RU O4')-(12 RU C1')-(12 RU N1)-(12 RU C2)	170.0	340.0
CHI	(15 RA O4')-(15 RA C1')-(15 RA N9)-(15 RA C4)	170.0	340.0
CHI	(16 RC O4')-(16 RC C1')-(16 RC N1)-(16 RC C2)	170.0	340.0
CHI	(17 RA O4')-(17 RA C1')-(17 RA N9)-(17 RA C4)	170.0	340.0
CHI	(18 RG O4')-(18 RG C1')-(18 RG N9)-(18 RG C4)	170.0	340.0
CHI	(19 RC O4')-(19 RC C1')-(19 RC N1)-(19 RC C2)	170.0	340.0
CHI	(21 RG O4')-(21 RG C1')-(21 RG N9)-(21 RG C4)	170.0	340.0
CHI	(22 RC O4')-(22 RC C1')-(22 RC N1)-(22 RC C2)	170.0	340.0
CHI	(23 RU O4')-(23 RU C1')-(23 RU N1)-(23 RU C2)	170.0	340.0
CHI	(24 RG O4')-(24 RG C1')-(24 RG N9)-(24 RG C4)	170.0	340.0
CHI	(25 RU O4')-(25 RU C1')-(25 RU N1)-(25 RU C2)	170.0	340.0

Table S4: NOE restraints used for modeling of the r(CUG)-**1** complex.

1	G	H1	26	C	N3	1.84	2.04
1	G	H1'	1	G	H4'	2.51	3.76
1	G	H1'	1	G	H8	2.66	3.99
1	G	H2'	1	G	H1'	2.36	3.53
1	G	H2'	1	G	H8	2.82	4.23
1	G	H2'	2	A	H1'	3.48	5.22
1	G	H2'	2	A	H8	2.26	3.39
1	G	H21	26	C	O2	1.75	1.95
1	G	H4'	1	G	H2'	2.61	3.92
1	G	N1	26	C	N3	2.85	3.05
1	G	O6	26	C	H41	1.8	2
1	G	O6	26	C	N4	2.81	3.01
2	A	H1'	2	A	H2'	2.24	3.36
2	A	H1'	2	A	H8	2.98	4.47
2	A	H1'	3	C	H1'	4	6.01
2	A	H2	2	A	H1'	3.69	5.54
2	A	H2	2	A	H2'	4.29	6.43
2	A	H2'	3	C	H5	2.7	4.06
2	A	H3'	2	A	H1'	2.93	4.4
2	A	H3'	2	A	H8	2.62	3.93
2	A	H3'	3	C	H6	3.24	4.86
2	A	H61	25	U	O4	1.84	2.04
2	A	H8	2	A	H2'	3.09	4.64
2	A	H8	3	C	H5	3.46	5.18
2	A	H8	3	C	H6	3.5	5.24
2	A	N1	25	U	H3	1.71	1.91
2	A	N1	25	U	N3	2.72	2.92
3	C	H1'	2	A	H2	2.69	4.04
3	C	H1'	3	C	H5	4.09	6.13
3	C	H1'	4	A	H1'	4.23	6.35
3	C	H2'	3	C	H1'	2.17	3.25
3	C	H2'	3	C	H5	3.62	5.43
3	C	H2'	3	C	H6	3.47	5.21
3	C	H2'	4	A	H8	2.02	3.03
3	C	H3'	4	A	H8	2.39	3.58
3	C	H41	24	G	O6	1.8	2
3	C	H5	2	A	H3'	2.83	4.25
3	C	H5	3	C	H6	2.04	3.06
3	C	H6	2	A	H2'	1.91	2.86
3	C	H6	3	C	H1'	2.58	3.87
3	C	N3	24	G	H1	1.84	2.04
3	C	N3	24	G	N1	2.85	3.05
3	C	N4	24	G	O6	2.81	3.01
3	C	O2	24	G	H21	1.75	1.95
4	A	H1'	3	C	H2'	3.17	4.76
4	A	H1'	4	A	H3'	3.12	4.68
4	A	H1'	4	A	H8	3.01	4.51
4	A	H2	4	A	H1'	3.84	5.76
4	A	H2	5	G	H1'	2.68	4.01

4	A	H2'	4	A	H1'	2.32	3.48
4	A	H2'	4	A	H8	2.87	4.31
4	A	H2'	5	G	H1'	3.45	5.18
4	A	H2'	5	G	H8	2.25	3.37
4	A	H3'	4	A	H8	2.69	4.04
4	A	H3'	5	G	H8	3.01	4.52
4	A	H4'	4	A	H1'	2.61	3.91
4	A	H61	23	U	O4	1.84	2.04
4	A	H8	3	C	H5	3.73	5.59
4	A	H8	3	C	H6	3.27	4.9
4	A	H8	5	G	H8	3.57	5.35
4	A	N1	23	U	H3	1.71	1.91
4	A	N1	23	U	N3	2.72	2.92
5	G	H1	22	C	N3	1.84	2.04
5	G	H1'	5	G	H2'	2.12	3.19
5	G	H1'	5	G	H8	2.87	4.31
5	G	H2'	5	G	H8	2.87	4.3
5	G	H2'	6	C	H1'	3.2	4.8
5	G	H2'	6	C	H5	2.7	4.07
5	G	H2'	6	C	H6	2.17	3.25
5	G	H21	22	C	O2	1.75	1.95
5	G	H3'	6	C	H6	2.3	3.45
5	G	H8	5	G	H3'	2.24	3.36
5	G	N1	22	C	N3	2.85	3.05
5	G	O6	22	C	H41	1.8	2
5	G	O6	22	C	N4	2.81	3.01
6	C	H1'	6	C	H5	3.84	5.76
6	C	H1'	6	C	H6	2.72	4.08
6	C	H2'	6	C	H1'	2.13	3.2
6	C	H2'	6	C	H6	2.9	4.35
6	C	H2'	7	U	H1'	2.25	3.38
6	C	H3'	7	U	H6	2.37	3.56
6	C	H41	21	G	O6	1.8	2
6	C	H5	5	G	H8	3.15	4.72
6	C	H5	6	C	H2'	3.79	5.69
6	C	H5	6	C	H6	2.03	3.04
6	C	H5	7	U	H6	3.28	4.92
6	C	H6	5	G	H8	3.59	5.38
6	C	H6	6	C	H3'	1.93	2.9
6	C	N3	21	G	H1	1.84	2.04
6	C	N3	21	G	N1	2.85	3.05
6	C	N4	21	G	O6	2.81	3.01
6	C	O2	21	G	H21	1.75	1.95
7	U	H1'	7	U	H2'	2.19	3.28
7	U	H1'	7	U	H6	2.42	3.63
7	U	H5	6	C	H2'	2.74	4.11
7	U	H5	6	C	H5	2.92	4.38
7	U	H5	6	C	H6	3.37	5.06
7	U	H5	7	U	H6	1.95	2.92
7	U	H6	6	C	H2'	2.2	3.3
7	U	H6	6	C	H6	3.74	5.6

7	U	H6	8	G	H8	2.88	5.05
8	G	H1	19	C	N3	1.84	2.04
8	G	H1'	7	U	H2'	3.02	4.52
8	G	H1'	8	G	H8	2.87	4.31
8	G	H2'	8	G	H1'	2.5	3.76
8	G	H2'	8	G	H8	3.44	5.15
8	G	H2'	9	C	H1'	3.34	5.01
8	G	H2'	9	C	H5	2.86	4.29
8	G	H21	19	C	O2	1.75	1.95
8	G	H3'	8	G	H8	3.23	4.85
8	G	H8	7	U	H2'	2.14	3.21
8	G	H8	7	U	H6	3.34	5.01
8	G	N1	19	C	N3	2.85	3.05
8	G	O6	19	C	H41	1.8	2
8	G	O6	19	C	N4	2.81	3.01
9	C	H1'	9	C	H2'	2.19	3.28
9	C	H1'	9	C	H5	3.93	5.89
9	C	H1'	9	C	H6	2.93	4.39
9	C	H2'	10	U	H5	2.71	4.06
9	C	H2'	10	U	H6	2.16	3.25
9	C	H41	18	G	O6	1.8	2
9	C	H5	8	G	H8	3.34	5.01
9	C	H5	9	C	H3'	3.14	4.71
9	C	H5	9	C	H6	2.15	3.23
9	C	H5	10	U	H5	2.97	4.45
9	C	H6	9	C	H2'	3.26	4.89
9	C	H6	10	U	H5	3.6	5.4
9	C	N3	18	G	H1	1.84	2.04
9	C	N3	18	G	N1	2.85	3.05
9	C	N4	18	G	O6	2.81	3.01
9	C	O2	18	G	H21	1.75	1.95
10	U	H3	17	A	N1	1.71	1.91
10	U	H5	9	C	H3'	3.35	5.02
10	U	H6	9	C	H3'	2.96	4.44
10	U	H6	9	C	H6	3.4	5.1
10	U	H6	10	U	H1'	2.68	4.03
10	U	H6	10	U	H5	2.15	3.22
10	U	N3	17	A	N1	2.72	2.92
10	U	O4	17	A	H61	1.84	2.04
11	G	H1	16	C	N3	1.84	2.04
11	G	H1'	11	G	H3'	2.6	3.89
11	G	H1'	12	U	H5	3.94	5.91
11	G	H2'	11	G	H1'	2.21	3.32
11	G	H21	16	C	O2	1.75	1.95
11	G	H3'	12	U	H5	2.92	4.39
11	G	H8	10	U	H1'	3.4	5.1
11	G	H8	11	G	H1'	3.39	5.08
11	G	H8	11	G	H2'	3.82	5.72
11	G	H8	11	G	H3'	2.67	4.01
11	G	H8	12	U	H5	3.84	5.75
11	G	N1	16	C	N3	2.85	3.05

11	G	O6	16	C	H41	1.8	2
11	G	O6	16	C	N4	2.81	3.01
12	U	H1'	11	G	H2'	3.07	4.61
12	U	H1'	12	U	H2'	2.07	3.1
12	U	H1'	12	U	H6	2.77	4.15
12	U	H2'	13	C	H5	2.81	4.22
12	U	H2'	13	C	H6	2	3
12	U	H3	15	A	N1	1.71	1.91
12	U	H3'	12	U	H1'	2.67	4.01
12	U	H3'	13	C	H6	3.34	5.02
12	U	H5	11	G	H2'	2.52	3.79
12	U	H5	12	U	H2'	3.76	5.64
12	U	H5	12	U	H6	2.01	3.02
12	U	H5	13	C	H5	2.86	4.29
12	U	H6	11	G	H2'	1.99	2.99
12	U	H6	11	G	H3'	2.3	3.45
12	U	H6	12	U	H2'	2.75	4.12
12	U	H6	12	U	H3'	2.04	3.06
12	U	H6	13	C	H5	3.39	5.09
12	U	N3	15	A	N1	2.72	2.92
12	U	O4	15	A	H61	1.84	2.04
13	C	H1'	12	U	H2'	2.85	4.27
13	C	H1'	13	C	H2'	1.98	2.97
13	C	H1'	13	C	H6	2.98	4.47
13	C	H2'	13	C	H6	2.67	4.01
13	C	H6	13	C	H3'	1.86	2.79
14	G	H1	13	C	N3	1.84	2.04
14	G	H1'	14	G	H4'	2.51	3.76
14	G	H1'	14	G	H8	2.66	3.99
14	G	H2'	14	G	H1'	2.36	3.53
14	G	H2'	14	G	H8	2.82	4.23
14	G	H2'	15	A	H1'	3.48	5.22
14	G	H2'	15	A	H8	2.26	3.39
14	G	H21	13	C	O2	1.75	1.95
14	G	H4'	14	G	H2'	2.61	3.92
14	G	N1	13	C	N3	2.85	3.05
14	G	O6	13	C	H41	1.8	2
14	G	O6	13	C	N4	2.81	3.01
15	A	H1'	15	A	H2'	2.24	3.36
15	A	H1'	15	A	H8	2.98	4.47
15	A	H1'	16	C	H1'	4	6.01
15	A	H2	15	A	H1'	3.69	5.54
15	A	H2	15	A	H2'	4.29	6.43
15	A	H2'	16	C	H5	2.7	4.06
15	A	H3'	15	A	H1'	2.93	4.4
15	A	H3'	15	A	H8	2.62	3.93
15	A	H3'	16	C	H6	3.24	4.86
15	A	H8	15	A	H2'	3.09	4.64
15	A	H8	16	C	H5	3.46	5.18
15	A	H8	16	C	H6	3.5	5.24
16	C	H1'	15	A	H2	2.69	4.04

16	C	H1'	16	C	H5	4.09	6.13
16	C	H1'	17	A	H1'	4.23	6.35
16	C	H2'	16	C	H1'	2.17	3.25
16	C	H2'	16	C	H5	3.62	5.43
16	C	H2'	16	C	H6	3.47	5.21
16	C	H2'	17	A	H8	2.02	3.03
16	C	H3'	17	A	H8	2.39	3.58
16	C	H5	15	A	H3'	2.83	4.25
16	C	H5	16	C	H6	2.04	3.06
16	C	H6	15	A	H2'	1.91	2.86
16	C	H6	16	C	H1'	2.58	3.87
17	A	H1'	16	C	H2'	3.17	4.76
17	A	H1'	17	A	H3'	3.12	4.68
17	A	H1'	17	A	H8	3.01	4.51
17	A	H2	17	A	H1'	3.84	5.76
17	A	H2	18	G	H1'	2.68	4.01
17	A	H2'	17	A	H1'	2.32	3.48
17	A	H2'	17	A	H8	2.87	4.31
17	A	H2'	18	G	H1'	3.45	5.18
17	A	H2'	18	G	H8	2.25	3.37
17	A	H3'	17	A	H8	2.69	4.04
17	A	H3'	18	G	H8	3.01	4.52
17	A	H4'	17	A	H1'	2.61	3.91
17	A	H8	16	C	H5	3.73	5.59
17	A	H8	16	C	H6	3.27	4.9
17	A	H8	18	G	H8	3.57	5.35
18	G	H1'	18	G	H2'	2.12	3.19
18	G	H1'	18	G	H8	2.87	4.31
18	G	H2'	18	G	H8	2.87	4.3
18	G	H2'	19	C	H1'	3.2	4.8
18	G	H2'	19	C	H5	2.7	4.06
18	G	H2'	19	C	H6	2.17	3.25
18	G	H3'	19	C	H6	2.3	3.45
18	G	H8	18	G	H3'	2.24	3.36
19	C	H1'	19	C	H5	3.84	5.76
19	C	H1'	19	C	H6	2.72	4.08
19	C	H2'	19	C	H1'	2.13	3.2
19	C	H2'	19	C	H6	2.9	4.35
19	C	H2'	20	U	H1'	2.25	3.38
19	C	H3'	20	U	H6	2.37	3.56
19	C	H5	18	G	H8	3.15	4.72
19	C	H5	19	C	H2'	3.79	5.69
19	C	H5	19	C	H6	2.03	3.04
19	C	H5	20	U	H6	3.28	4.92
19	C	H6	18	G	H8	3.59	5.38
19	C	H6	19	C	H3'	1.93	2.9
20	U	H1'	20	U	H2'	2.19	3.28
20	U	H1'	20	U	H6	2.42	3.63
20	U	H5	19	C	H2'	2.74	4.11
20	U	H5	19	C	H5	2.92	4.38
20	U	H5	19	C	H6	3.37	5.06

20	U	H5	20	U	H6	1.95	2.92
20	U	H6	19	C	H2'	2.2	3.3
20	U	H6	19	C	H6	3.74	5.6
20	U	H6	21	G	H8	2.88	5.05
21	G	H1'	20	U	H2'	3.02	4.52
21	G	H1'	21	G	H8	2.87	4.31
21	G	H2'	21	G	H1'	2.5	3.76
21	G	H2'	21	G	H8	3.44	5.15
21	G	H2'	22	C	H1'	3.34	5.01
21	G	H2'	22	C	H6	2.91	4.36
21	G	H3'	21	G	H8	3.23	4.85
21	G	H8	20	U	H2'	2.14	3.21
21	G	H8	20	U	H6	3.34	5.01
22	C	H1'	22	C	H2'	2.19	3.28
22	C	H1'	22	C	H5	3.93	5.89
22	C	H1'	22	C	H6	2.93	4.39
22	C	H2'	23	U	H5	2.71	4.06
22	C	H2'	23	U	H6	2.16	3.25
22	C	H5	21	G	H8	3.34	5.01
22	C	H5	22	C	H3'	3.14	4.71
22	C	H5	22	C	H6	2.15	3.23
22	C	H5	23	U	H5	2.97	4.45
22	C	H6	22	C	H2'	3.26	4.89
22	C	H6	23	U	H5	3.6	5.4
23	U	H5	22	C	H3'	3.35	5.02
23	U	H6	22	C	H3'	2.96	4.44
23	U	H6	22	C	H6	3.4	5.1
23	U	H6	23	U	H1'	2.68	4.03
23	U	H6	23	U	H5	2.15	3.22
24	G	H1'	24	G	H3'	2.6	3.89
24	G	H1'	25	U	H5	3.94	5.91
24	G	H2'	24	G	H1'	2.21	3.32
24	G	H3'	25	U	H5	2.92	4.39
24	G	H8	23	U	H1'	3.4	5.1
24	G	H8	24	G	H1'	3.39	5.08
24	G	H8	24	G	H2'	3.82	5.72
24	G	H8	24	G	H3'	2.67	4.01
24	G	H8	25	U	H5	3.84	5.75
25	U	H1'	24	G	H2'	3.07	4.61
25	U	H1'	25	U	H2'	2.07	3.1
25	U	H1'	25	U	H6	2.77	4.15
25	U	H2'	26	C	H5	2.81	4.22
25	U	H2'	26	C	H6	2	3
25	U	H3'	25	U	H1'	2.67	4.01
25	U	H3'	26	C	H6	3.34	5.02
25	U	H5	24	G	H2'	2.52	3.79
25	U	H5	25	U	H2'	3.76	5.64
25	U	H5	25	U	H6	2.01	3.02
25	U	H5	26	C	H5	2.86	4.29
25	U	H6	24	G	H2'	1.99	2.99
25	U	H6	24	G	H3'	2.3	3.45

25	U	H6	25	U	H2'	2.75	4.12
25	U	H6	25	U	H3'	2.04	3.06
25	U	H6	26	C	H5	3.39	5.09
26	C	H1'	25	U	H2'	2.85	4.27
26	C	H1'	26	C	H2'	1.98	2.97
26	C	H1'	26	C	H6	2.98	4.47
26	C	H2'	26	C	H6	2.67	4.01
26	C	H6	26	C	H3'	1.86	2.79
27	**1**	H1	6	C	H2'	3	6
27	**1**	H1	6	C	H5	3	6
27	**1**	H1	7	U	H1'	3	6
27	**1**	H1	7	U	H5	3	6
27	**1**	H1	7	U	H6	3	6
27	**1**	H1	8	G	H1'	3	6
27	**1**	H1	8	G	H8	3	6
27	**1**	H3	6	C	H2'	3	6
27	**1**	H3	6	C	H5	3	6
27	**1**	H3	7	U	H5	3	6
27	**1**	H3	7	U	H6	3	6
27	**1**	H3	8	G	H1'	3	6
27	**1**	H3	8	G	H8	3	6
27	**1**	H5	19	C	H2'	3	6
27	**1**	H5	20	U	H1'	3	6
27	**1**	H5	20	U	H5	3	6
27	**1**	H5	20	U	H6	3	6
27	**1**	H5	21	G	H1'	3	6
27	**1**	H5	21	G	H8	3	6
27	**1**	H7	20	U	H1'	3	6
27	**1**	H7	20	U	H5	3	6
27	**1**	H7	20	U	H6	3	6
27	**1**	H7	21	G	H1'	3	6
27	**1**	H7	21	G	H8	3	6

Table S5: Distance restraint violations greater than 0.1 Å for the r(CUG)-**1** complex.

No. of violations ≥ 0.1 Å	Mean violation† (Å)	Assignment	Minimum distance (Å)	Maximum distance (Å)
10	0.095	**1**27H3-C6H2′	3.00	6.00
1	0.052	C19H2′-U20H1′	2.25	3.38

† Includes violations < 0.1 Å

Table S6: NOE restraints used for modeling of the r(CUG)-**2** complex.

1	G	H1	2	A	H1'	3.32	5.19
1	G	H1	2	A	H2	3.42	5.34
1	G	H1	26	C	H42	3.4	5.31
1	G	H1	26	C	N3	1.8	2.4
1	G	H1'	1	G	H2'	2.12	3.46
1	G	H1'	1	G	H8	2.7	4.22
1	G	H22	26	C	O2	1.8	2.4
1	G	H3'	1	G	H1'	2.58	3.86
1	G	H8	1	G	H2'	2.8	4.38
1	G	O6	26	C	H41	1.8	2.4
2	A	H1'	2	A	H2'	2.15	3.23
2	A	H1'	2	A	H3'	2.51	3.99
2	A	H1'	2	A	H4'	2.77	4.41
2	A	H1'	2	A	H4'	2.77	4.41
2	A	H2	2	A	H1'	3	6
2	A	H2	2	A	H1'	3	6
2	A	H2	3	C	H1'	2.57	3.88
2	A	H2	3	C	H1'	2.84	4.52
2	A	H2	26	C	H1'	3.12	4.88
2	A	H61	25	U	O4	1.8	2.4
2	A	H8	1	G	H1'	3.04	4.75
2	A	H8	1	G	H2'	1.6	2.94
2	A	H8	2	A	H1'	2.88	4.48
2	A	H8	2	A	H2'	2.75	4.25
2	A	H8	2	A	H3'	2	3.29
2	A	H8	3	C	H5	2.96	4.63
2	A	N1	25	U	H3	1.8	2.4
3	C	H1'	3	C	H2'	2.07	3.39
3	C	H1'	3	C	H4'	2.83	9.22
3	C	H41	24	G	O6	1.8	2.4
3	C	H5	2	A	H2'	3.04	4.75
3	C	H5	3	C	H3'	2.88	4.48
3	C	H6	2	A	H1'	3.84	5.25
3	C	H6	2	A	H2'	1.7	3
3	C	H6	2	A	H3'	2.53	8.85
3	C	H6	3	C	H1'	2.74	4.17
3	C	H6	3	C	H2'	2.75	4.1
3	C	H6	3	C	H4'	2.78	4.33
3	C	H6	4	A	H8	2.8	4.375
3	C	N3	24	G	H1	1.8	2.4
3	C	O2	24	G	H22	1.8	2.4
4	A	H1'	4	A	H2'	2.26	3.63
4	A	H2	4	A	H1'	3.04	4.75
4	A	H2	5	G	H1'	2.96	4.63
4	A	H2	24	G	H1'	2.72	3.89
4	A	H61	23	U	O4	1.8	2.4
4	A	H8	3	C	H1'	2.88	4.5
4	A	H8	3	C	H2'	1.88	3.34
4	A	H8	3	C	H3'	2.88	4.5

4	A	H8	4	A	H1'	2.75	4.1
4	A	H8	4	A	H2'	3.04	4.75
4	A	H8	4	A	H3'	2.72	4.25
4	A	N1	23	U	H3	1.8	2.4
5	G	H1	22	C	H41	2.78	4.34
5	G	H1	22	C	N3	1.8	2.4
5	G	H1	23	U	H1'	2.74	4.28
5	G	H1'	5	G	H2'	2.11	3.43
5	G	H1'	5	G	H3'	2.57	3.78
5	G	H2'	5	G	H1'	2.14	3.51
5	G	H2'	6	C	H5	2.94	4.55
5	G	H22	22	C	O2	1.8	2.4
5	G	H3'	6	C	H5	2.65	3.94
5	G	H3'	6	C	H5	2.65	3.99
5	G	H4'	5	G	H1'	2.56	4.06
5	G	H8	4	A	H1'	3.12	4.875
5	G	H8	4	A	H2'	1.95	3.36
5	G	H8	4	A	H3'	1.92	3
5	G	H8	5	G	H1'	2.77	4.09
5	G	H8	5	G	H2'	2.74	4.42
5	G	H8	5	G	H3'	2.08	3.25
5	G	H8	6	C	H5	2.75	3.91
5	G	O6	22	C	H41	1.8	2.4
6	C	H1'	5	G	H2'	3.21	4.78
6	C	H1'	6	C	H3'	2.8	4.38
6	C	H3'	6	C	H5	2.96	4.63
6	C	H4'	6	C	H1'	2.18	3.91
6	C	H6	5	G	H1'	3.2	5
6	C	H6	5	G	H2'	1.83	2.9
6	C	H6	5	G	H3'	2	3.06
6	C	H6	5	G	H8	3.84	5.25
6	C	H6	6	C	H1'	2.96	4.03
6	C	H6	6	C	H2'	2.75	4.1
6	C	H6	6	C	H3'	2	3.13
6	C	H6	6	C	H4'	2.8	4.38
7	U	H1'	7	U	H6	2.8	4.38
7	U	H6	6	C	H1'	4.4	5.5
7	U	H6	6	C	H2'	2.48	3.88
7	U	H6	6	C	H3'	3	5
7	U	H6	7	U	H1'	2.8	4.17
7	U	H6	7	U	H2'	2.8	4.17
8	G	H4'	8	G	H1'	2.64	4.13
8	G	H8	7	U	H2'	2.32	3.63
8	G	H8	8	G	H1'	2.8	4.45
8	G	H8	8	G	H2'	2.22	3.71
9	C	H1'	9	C	H2'	2.1	3.55
9	C	H1'	9	C	H3'	2.22	4.4
9	C	H2'	10	U	H5	2.91	4.28
9	C	H3'	10	U	H5	2.72	4.1
9	C	H41	18	G	O6	1.8	2.4
9	C	H6	8	G	H1'	2.72	4.25

9	C	H6	9	C	H2'	2.8	4.63
9	C	H6	9	C	H3'	2.09	3.49
9	C	H6	10	U	H5	3.12	4.88
9	C	N3	18	G	H1	1.8	2.4
9	C	O2	18	G	H22	1.8	2.4
10	U	H3	11	G	H1	3.69	5.77
10	U	H3	17	A	H2	2.28	3.56
10	U	H3	17	A	N1	1.8	2.4
10	U	H3	18	G	H1	2.28	3.56
10	U	H6	9	C	H1'	3.04	5
10	U	H6	9	C	H2'	1.85	3.19
10	U	H6	9	C	H3'	2.19	3.36
10	U	H6	10	U	H1'	3.6	5.57
10	U	H6	11	G	H8	3.04	4.75
10	U	O4	17	A	H61	1.8	2.4
11	G	H1	15	A	H2	2.64	4.13
11	G	H1	16	C	H41	2.65	4.14
11	G	H1	16	C	N3	1.8	2.4
11	G	H1'	11	G	H2'	2.22	3.71
11	G	H1'	11	G	H4'	2.64	3.93
11	G	H22	16	C	O2	1.8	2.4
11	G	H8	10	U	H1'	3.69	5.77
11	G	H8	11	G	H1'	2.96	4.03
11	G	H8	11	G	H2'	2.64	4.13
11	G	H8	11	G	H3'	2	3.29
11	G	O6	16	C	H41	1.8	2.4
12	U	H1'	11	G	H2'	3.41	5.41
12	U	H1'	12	U	H2'	2.09	3.51
12	U	H1'	12	U	H3'	2.99	4.53
12	U	H3	11	G	H1	2.92	4.56
12	U	H3	12	U	H1'	3.44	5.38
12	U	H3	12	U	H2'	3.55	5.55
12	U	H3	15	A	H2	2.12	3.31
12	U	H3	15	A	N1	1.8	2.4
12	U	H3	16	C	H41	3.26	5.1
12	U	H4'	12	U	H1'	2.79	4.41
12	U	H6	11	G	H2'	1.75	2.92
12	U	H6	11	G	H3'	2	3.53
12	U	H6	12	U	H1'	3.6	5.57
12	U	H6	12	U	H3'	2	3.18
12	U	O4	15	A	H61	1.8	2.4
13	C	H1'	12	U	H2'	3.29	4.73
13	C	H41	14	G	O6	1.8	2.4
13	C	H5	12	U	H2'	3.68	4.6
13	C	H5	12	U	H3'	2.96	3.7
13	C	H5	12	U	H5	2.99	4.53
13	C	H6	12	U	H1'	3.12	4.875
13	C	H6	12	U	H2'	1.75	2.92
13	C	H6	12	U	H3'	2.72	4.25
13	C	H6	13	C	H1'	2.55	3.96
13	C	H6	13	C	H2'	2.75	4.1

13	C	H6	13	C	H3'	2	2.5
13	C	N3	14	G	H1	1.8	2.4
13	C	O2	14	G	H22	1.8	2.4
14	G	H1	15	A	H1'	3.32	5.19
14	G	H1	15	A	H2	3.42	5.34
14	G	H1'	14	G	H2'	2.12	3.46
14	G	H1'	14	G	H8	2.7	4.22
14	G	H3'	14	G	H1'	2.58	3.86
14	G	H8	14	G	H2'	2.8	4.38
15	A	H1'	15	A	H2'	2.15	3.23
15	A	H1'	15	A	H3'	2.51	3.99
15	A	H2	13	C	H1'	3.12	4.88
15	A	H2	16	C	H1'	2.8	4.38
15	A	H2	16	C	H1'	2.84	4.52
15	A	H8	14	G	H1'	3.04	4.75
15	A	H8	14	G	H2'	1.6	2.94
15	A	H8	15	A	H1'	2.88	4.48
15	A	H8	15	A	H2'	2.75	4.1
15	A	H8	15	A	H3'	2	3.29
15	A	H8	16	C	H5	2.96	4.63
16	C	H1'	16	C	H2'	2.07	3.39
16	C	H1'	16	C	H4'	2.83	9.22
16	C	H5	15	A	H2'	3.04	4.75
16	C	H5	16	C	H3'	2.88	4.48
16	C	H6	15	A	H1'	3.84	5.25
16	C	H6	15	A	H2'	1.7	3
16	C	H6	15	A	H3'	2.53	3.85
16	C	H6	16	C	H1'	2.74	4.17
16	C	H6	16	C	H2'	2.75	4.1
16	C	H6	16	C	H4'	2.78	4.33
16	C	H6	17	A	H8	2.8	4.375
17	A	H1'	17	A	H2'	2.26	3.63
17	A	H2	11	G	H1'	2.88	4.5
17	A	H2	17	A	H1'	3.04	4.75
17	A	H2	18	G	H1'	2.96	4.63
17	A	H8	16	C	H1'	2.88	4.5
17	A	H8	16	C	H2'	1.88	3.34
17	A	H8	16	C	H3'	2.88	4.5
17	A	H8	17	A	H1'	2.75	4.1
17	A	H8	17	A	H2'	3.04	4.75
17	A	H8	17	A	H3'	2.72	4.25
18	G	H1'	18	G	H2'	2.11	3.43
18	G	H1'	18	G	H3'	2.57	3.78
18	G	H2'	18	G	H1'	2.14	3.51
18	G	H2'	19	C	H5	2.94	4.55
18	G	H3'	19	C	H5	2.65	3.94
18	G	H3'	19	C	H5	2.65	3.99
18	G	H4'	18	G	H1'	2.56	4.06
18	G	H8	17	A	H1'	3.12	4.875
18	G	H8	17	A	H2'	1.95	3.36
18	G	H8	17	A	H3'	1.92	3

18	G	H8	18	G	H1'	2.77	4.09
18	G	H8	18	G	H2'	2.74	4.42
18	G	H8	18	G	H3'	2.08	3.25
18	G	H8	19	C	H5	2.75	3.91
19	C	H1'	18	G	H2'	3.21	4.78
19	C	H1'	19	C	H3'	2.8	4.38
19	C	H3'	19	C	H5	2.96	4.63
19	C	H4'	19	C	H1'	2.18	3.91
19	C	H6	18	G	H1'	3.2	5
19	C	H6	18	G	H2'	1.83	2.9
19	C	H6	18	G	H3'	2	3.06
19	C	H6	18	G	H8	3.84	5.25
19	C	H6	19	C	H1'	2.96	4.03
19	C	H6	19	C	H2'	2.75	4.1
19	C	H6	19	C	H3'	2	3.13
19	C	H6	19	C	H4'	2.8	4.38
20	U	H1'	20	U	H6	2.8	4.38
20	U	H6	19	C	H1'	4.4	5.5
20	U	H6	19	C	H2'	2.48	3.88
20	U	H6	19	C	H3'	3	5
20	U	H6	20	U	H1'	2.8	4.17
20	U	H6	20	U	H2'	2.8	4.17
21	G	H4'	21	G	H1'	2.64	4.13
21	G	H8	20	U	H2'	2.32	3.63
21	G	H8	21	G	H1'	2.8	4.45
21	G	H8	21	G	H2'	2.22	3.71
22	C	H1'	22	C	H2'	2.1	3.55
22	C	H1'	22	C	H3'	2.22	4.4
22	C	H2'	23	U	H5	2.91	4.28
22	C	H3'	23	U	H5	2.72	4.1
22	C	H6	21	G	H1'	2.72	4.25
22	C	H6	22	C	H2'	2.8	4.63
22	C	H6	22	C	H3'	2.09	3.49
22	C	H6	23	U	H5	3.12	4.88
23	U	H3	4	A	H2	2.28	3.56
23	U	H3	5	G	H1	3.26	5.1
23	U	H6	22	C	H1'	3.04	5
23	U	H6	22	C	H2'	1.85	3.19
23	U	H6	22	C	H3'	2.19	3.36
23	U	H6	23	U	H1'	3.6	5.57
23	U	H6	24	G	H8	3.04	4.75
24	G	H1	2	A	H2	2.64	4.13
24	G	H1'	24	G	H2'	2.22	3.71
24	G	H8	23	U	H1'	3.69	5.77
24	G	H8	24	G	H1'	2.96	4.03
24	G	H8	24	G	H2'	2.64	4.13
24	G	H8	24	G	H3'	2	3.29
25	U	H1'	24	G	H2'	3.41	5.41
25	U	H1'	25	U	H2'	2.09	3.51
25	U	H1'	25	U	H3'	2.99	4.53
25	U	H3	2	A	H2	2.12	3.31

25	U	H4'	25	U	H1'	2.79	4.41
25	U	H6	24	G	H2'	1.75	2.92
25	U	H6	24	G	H3'	2	3.53
25	U	H6	25	U	H1'	3.6	5.57
25	U	H6	25	U	H3'	2	3.18
26	C	H1'	25	U	H2'	3.29	4.73
26	C	H5	25	U	H2'	3.68	4.6
26	C	H5	25	U	H3'	2.96	3.7
26	C	H5	25	U	H5	2.89	3.61
26	C	H6	25	U	H1'	3.12	4.875
26	C	H6	25	U	H2'	1.75	2.92
26	C	H6	25	U	H3'	2.72	4.25
26	C	H6	26	C	H1'	2.55	3.96
26	C	H6	26	C	H2'	2.75	4.1
27	**2**	H1	6	C	H1'	3	6
27	**2**	H1	7	U	H5	3	6
27	**2**	H1	7	U	H6	3	5
27	**2**	H13	20	U	H6	3	5
27	**2**	H13	21	G	H5''	3	5
27	**2**	H17	27	D6L	H8	3	5
27	**2**	H19	27	D6L	H8	2.5	5
27	**2**	H26	7	U	H3	3	5
27	**2**	H26	7	U	H3	2	4
27	**2**	H3	6	C	H1'	3	6.5
27	**2**	H4	7	U	H3	2	4
27	**2**	H4	7	U	H5	3	6
27	**2**	H5	19	C	H2'	3	5
27	**2**	H5	19	C	H5	3	5
27	**2**	H5	19	C	H5	3	5
27	**2**	H5	19	C	H6	3	5
27	**2**	H5	20	U	H5	3	5
27	**2**	H5	20	U	H6	3	5
27	**2**	H6	20	U	H3	3	5
27	**2**	H6	20	U	H3	2	4
27	**2**	H7	19	C	H3'	3	5
27	**2**	H7	19	C	H3'	3	5
27	**2**	H7	19	C	H5	3	5
27	**2**	H7	20	U	H2'	4	6
27	**2**	H7	20	U	H5	2.5	5

Table S7: NOE restraints used for modeling of the r(CUG)-**3** complex.

1	G	H1	26	C	N3	1.8	2.4
1	G	H1'	1	G	H2'	2.27	3.55
1	G	H1'	1	G	H3'	3.56	5.56
1	G	H1'	1	G	H4'	2.62	4.09
1	G	H22	26	C	O2	1.8	2.4
1	G	H8	1	G	H1'	2.66	4.16
1	G	H8	1	G	H2'	2.34	3.8
1	G	H8	1	G	H3'	2.16	3.51
1	G	H8	1	G	H5'	2.42	3.79
1	G	H8	2	A	H8	3.36	5.25
1	G	O6	26	C	H41	1.8	2.4
2	A	H1'	2	A	H2	3.12	5.07
2	A	H1'	2	A	H3'	2.65	4.14
2	A	H1'	2	A	H4'	2.16	3.51
2	A	H2	2	A	H1'	2.96	4.81
2	A	H2	3	C	H1'	2.56	4.16
2	A	H2	26	C	H1'	2.96	4.81
2	A	H61	25	U	O4	1.8	2.4
2	A	H8	1	G	H1'	3.23	5.05
2	A	H8	1	G	H2'	2.34	3.8
2	A	H8	1	G	H3'	2.34	3.8
2	A	H8	1	G	H8	3.23	5.05
2	A	H8	2	A	H1'	2.63	4.11
2	A	H8	2	A	H2'	2.34	3.8
2	A	H8	2	A	H3'	2.1	3.28
2	A	H8	3	C	H6	3.23	5.05
2	A	N1	25	U	H3	1.8	2.4
3	C	H1'	2	A	H2'	2.64	4.29
3	C	H1'	3	C	H2'	2.14	3.34
3	C	H1'	3	C	H3'	2.32	3.77
3	C	H1'	3	C	H4'	2.81	4.4
3	C	H41	24	G	O6	1.8	2.4
3	C	H5	2	A	H2'	3.23	5.05
3	C	H5	2	A	H3'	2.57	4.02
3	C	H5	3	C	H3'	2.81	4.4
3	C	H6	2	A	H1'	3.23	5.05
3	C	H6	2	A	H2'	1.89	3.32
3	C	H6	2	A	H3'	2.47	3.85
3	C	H6	2	A	H8	3.23	5.05
3	C	H6	3	C	H1'	2.57	4.02
3	C	H6	3	C	H3'	1.88	2.94
3	C	H6	3	C	H5''	3.23	5.05
3	C	H6	4	A	H8	3.23	5.05
3	C	N3	24	G	H1	1.8	2.4
3	C	O2	24	G	H22	1.8	2.4
4	A	H1'	3	C	H2'	2.48	4.03
4	A	H1'	4	A	H4'	2.93	4.57
4	A	H1'	5	G	H8	2.88	4.68
4	A	H2	4	A	H1'	2.96	4.81

4	A	H2	5	G	H1'	2.72	4.42
4	A	H2	24	G	H1'	2.74	4.28
4	A	H61	23	U	O4	1.8	2.4
4	A	H8	3	C	H1'	3.12	5.07
4	A	H8	3	C	H2'	1.61	2.52
4	A	H8	3	C	H3'	2.16	3.38
4	A	H8	3	C	H5	3.81	5.95
4	A	H8	3	C	H6	3.23	5.05
4	A	H8	4	A	H1'	2.74	4.29
4	A	H8	4	A	H2'	2.57	4.02
4	A	H8	4	A	H3'	2.57	4.02
4	A	N1	23	U	H3	1.8	2.4
5	G	H1	22	C	N3	1.8	2.4
5	G	H1'	4	A	H2'	4.09	6.38
5	G	H1'	5	G	H2'	2.11	3.29
5	G	H1'	5	G	H3'	3.56	5.56
5	G	H1'	5	G	H4'	2.95	4.61
5	G	H22	22	C	O2	1.8	2.4
5	G	H8	4	A	H1'	2.93	4.58
5	G	H8	4	A	H2'	2.07	3.36
5	G	H8	4	A	H3'	3.17	4.96
5	G	H8	4	A	H8	4.28	6.95
5	G	H8	5	G	H1'	2.95	4.62
5	G	H8	5	G	H2'	3.04	4.75
5	G	H8	5	G	H3'	2.33	3.64
5	G	O6	22	C	H41	1.8	2.4
6	C	H1'	5	G	H2'	2.72	4.42
6	C	H1'	6	C	H2'	2.06	3.22
6	C	H1'	6	C	H3'	2.5	4.38
6	C	H1'	6	C	H4'	2.5	4.38
6	C	H3'	7	U	H5	2.5	4.38
6	C	H41	21	G	O6	1.8	2.4
6	C	H5	5	G	H2'	2.9	4.53
6	C	H5	5	G	H8	2.75	4.3
6	C	H6	5	G	H1'	3.12	5.07
6	C	H6	5	G	H2'	1.77	3.09
6	C	H6	5	G	H3'	2.27	3.54
6	C	H6	5	G	H8	3.48	6.09
6	C	H6	6	C	H1'	2.64	4.12
6	C	H6	6	C	H2'	2.3	3.74
6	C	H6	6	C	H3'	2.5	4.38
6	C	H6	6	C	H5	2.01	3.15
6	C	H6	6	C	H5"	2.73	4.27
6	C	N3	21	G	H1	1.8	2.4
6	C	O2	21	G	H22	1.8	2.4
7	U	H1'	6	C	H2'	2.67	4.17
7	U	H1'	7	U	H2'	2.3	4.03
7	U	H1'	7	U	H3'	3.36	5.25
7	U	H1'	7	U	H4'	2.92	4.56
7	U	H6	6	C	H1'	3.36	5.25
7	U	H6	6	C	H2'	2.01	3.15

7	U	H6	7	U	H1'	2.59	4.21
7	U	H6	7	U	H2'	2.64	4.63
7	U	H6	7	U	H3'	3.36	5.25
7	U	H6	7	U	H4'	2.5	4.38
7	U	H6	7	U	H5''	2.44	3.81
8	G	H1	19	C	N3	1.8	2.4
8	G	H22	19	C	O2	1.8	2.4
8	G	H8	7	U	H1'	3.2	5
8	G	H8	7	U	H2'	2.05	3.2
8	G	H8	7	U	H3'	3.36	5.25
8	G	H8	8	G	H1'	2.59	4.04
8	G	H8	8	G	H2'	2.98	4.65
8	G	O6	19	C	H41	1.8	2.4
9	C	H1'	8	G	H2'	3.89	6.08
9	C	H1'	9	C	H2'	2.25	3.51
9	C	H1'	9	C	H3'	2.98	4.65
9	C	H41	18	G	O6	1.8	2.4
9	C	H5	8	G	H2'	2.61	4.07
9	C	H5	9	C	H3'	2.8	4.37
9	C	H6	8	G	H1'	2.98	5
9	C	H6	8	G	H2'	1.95	3.16
9	C	H6	9	C	H1'	2.56	4.01
9	C	H6	9	C	H2'	2.98	4.65
9	C	H6	9	C	H3'	2.1	3.68
9	C	H6	9	C	H5	2.05	3.21
9	C	N3	18	G	H1	1.8	2.4
9	C	O2	18	G	H22	1.8	2.4
10	U	H3	17	A	N1	1.8	2.4
10	U	H5	9	C	H2'	2.61	4.07
10	U	H5	9	C	H3'	2.68	4.18
10	U	H5	10	U	H2'	4.65	7.26
10	U	H6	9	C	H1'	3.12	5.07
10	U	H6	9	C	H2'	1.97	3.08
10	U	H6	9	C	H3'	2.45	3.82
10	U	H6	9	C	H5	3.81	5.95
10	U	H6	10	U	H1'	2.6	4.07
10	U	H6	10	U	H2'	2.39	3.73
10	U	H6	10	U	H5	2.06	3.22
10	U	O4	17	A	H61	1.8	2.4
11	G	H1	16	C	N3	1.8	2.4
11	G	H1'	11	G	H2'	2.27	3.55
11	G	H1'	11	G	H3'	3.38	5.28
11	G	H22	16	C	O2	1.8	2.4
11	G	H8	10	U	H1'	2.79	4.88
11	G	H8	10	U	H2'	1.97	3.08
11	G	H8	10	U	H5	3.01	4.71
11	G	H8	11	G	H1'	3.16	4.93
11	G	H8	11	G	H3'	2.51	3.93
11	G	O6	16	C	H41	1.8	2.4
12	U	H1'	12	U	H2'	2.07	3.23
12	U	H1'	12	U	H3'	2.72	4.25

12	U	H1'	12	U	H4'	2.72	4.25
12	U	H3	15	A	N1	1.8	2.4
12	U	H3'	12	U	H5	3.12	5.07
12	U	H5	11	G	H2'	3.65	5.93
12	U	H5	11	G	H3'	3.65	5.93
12	U	H6	11	G	H1'	3.03	4.73
12	U	H6	11	G	H2'	1.87	2.92
12	U	H6	11	G	H3'	2.39	3.73
12	U	H6	12	U	H1'	2.7	4.72
12	U	H6	12	U	H2'	2.8	4.37
12	U	H6	12	U	H3'	1.93	3.39
12	U	H6	12	U	H5	2	3.12
12	U	H6	12	U	H5''	2.71	4.24
12	U	O4	15	A	H61	1.8	2.4
13	C	H1'	12	U	H2'	2.96	4.81
13	C	H1'	13	C	H2'	1.99	3.11
13	C	H3'	13	C	H2'	1.79	2.8
13	C	H41	14	G	O6	1.8	2.4
13	C	H5	12	U	H2'	2.85	4.46
13	C	H5	12	U	H3'	3.31	5.17
13	C	H5	12	U	H6	2.67	4.67
13	C	H5	13	C	H2'	3.26	5.1
13	C	H5	13	C	H3'	3.04	4.76
13	C	H6	12	U	H1'	3.43	5.36
13	C	H6	12	U	H2'	1.83	2.86
13	C	H6	12	U	H3'	2.15	3.77
13	C	H6	13	C	H1'	2.48	3.87
13	C	H6	13	C	H2'	2.26	3.67
13	C	H6	13	C	H3'	1.89	2.95
13	C	H6	13	C	H5''	2.79	4.35
13	C	N3	14	G	H1	1.8	2.4
13	C	O2	14	G	H22	1.8	2.4
14	G	H1'	14	G	H2'	2.27	3.55
14	G	H1'	14	G	H3'	3.56	5.56
14	G	H1'	14	G	H4'	2.62	4.09
14	G	H4'	14	G	H5''	2	3.13
14	G	H8	14	G	H1'	2.66	4.16
14	G	H8	14	G	H2'	2.34	3.8
14	G	H8	14	G	H3'	2.16	3.51
14	G	H8	15	A	H8	3.36	5.25
15	A	H1'	15	A	H2	3.12	5.07
15	A	H1'	15	A	H3'	2.65	4.14
15	A	H2	13	C	H1'	2.64	4.29
15	A	H2	15	A	H1'	2.96	4.81
15	A	H2	16	C	H1'	2.57	4.01
15	A	H8	14	G	H1'	3.23	5.05
15	A	H8	14	G	H2'	2.34	3.8
15	A	H8	14	G	H3'	2.34	3.8
15	A	H8	14	G	H8	3.23	5.05
15	A	H8	15	A	H1'	2.63	4.11
15	A	H8	15	A	H2'	2.34	3.8

15	A	H8	15	A	H3'	2.1	3.28
15	A	H8	16	C	H6	3.23	5.05
16	C	H1'	15	A	H2'	2.64	4.29
16	C	H1'	16	C	H2'	2.14	3.34
16	C	H1'	16	C	H3'	2.32	3.77
16	C	H1'	16	C	H4'	2.81	4.4
16	C	H5	15	A	H2'	3.23	5.05
16	C	H5	15	A	H3'	2.57	4.02
16	C	H5	16	C	H3'	2.73	4.27
16	C	H6	15	A	H1'	3.23	5.05
16	C	H6	15	A	H2'	1.89	3.32
16	C	H6	15	A	H3'	2.47	3.85
16	C	H6	15	A	H8	3.23	5.05
16	C	H6	16	C	H1'	2.57	4.02
16	C	H6	16	C	H3'	1.88	2.94
16	C	H6	16	C	H5''	3.23	5.05
16	C	H6	17	A	H8	3.23	5.05
17	A	H1'	16	C	H2'	2.93	4.58
17	A	H1'	18	G	H8	2.93	4.58
17	A	H2	10	U	H1'	3	6
17	A	H2	11	G	H1'	2.74	4.28
17	A	H2	17	A	H1'	2.96	4.81
17	A	H2	18	G	H1'	2.9	4.53
17	A	H8	16	C	H1'	3.12	5.07
17	A	H8	16	C	H2'	1.61	2.52
17	A	H8	16	C	H3'	2.16	3.38
17	A	H8	16	C	H5	3.81	5.95
17	A	H8	16	C	H6	3.23	5.05
17	A	H8	17	A	H1'	2.74	4.29
17	A	H8	17	A	H2'	2.57	4.02
17	A	H8	17	A	H3'	2.57	4.02
18	G	H1'	17	A	H2'	4.09	6.38
18	G	H1'	18	G	H2'	2.11	3.29
18	G	H1'	18	G	H3'	3.56	5.56
18	G	H1'	18	G	H4'	2.95	4.61
18	G	H8	17	A	H1'	2.93	4.58
18	G	H8	17	A	H2'	2.07	3.36
18	G	H8	17	A	H3'	3.17	4.96
18	G	H8	17	A	H8	4.4	6.87
18	G	H8	18	G	H1'	2.95	4.62
18	G	H8	18	G	H2'	3.04	4.75
18	G	H8	18	G	H3'	2.33	3.64
18	G	H8	18	G	H5''	2.76	4.49
19	C	H1'	18	G	H2'	2.44	4.27
19	C	H1'	19	C	H2'	2.06	3.22
19	C	H1'	19	C	H3'	2.5	4.38
19	C	H1'	19	C	H4'	2.5	4.38
19	C	H5	18	G	H2'	2.9	4.53
19	C	H5	18	G	H8	2.75	4.3
19	C	H6	18	G	H1'	3.12	5.07
19	C	H6	18	G	H2'	1.77	3.09

19	C	H6	18	G	H3'	2.27	3.54
19	C	H6	18	G	H8	3.48	6.09
19	C	H6	19	C	H1'	2.64	4.12
19	C	H6	19	C	H2'	2.42	3.78
19	C	H6	19	C	H3'	2.42	3.78
19	C	H6	19	C	H5''	2.73	4.27
20	U	H1'	19	C	H2'	2.5	4.38
20	U	H1'	20	U	H2'	2.3	4.03
20	U	H1'	20	U	H3'	3.36	5.25
20	U	H6	19	C	H1'	3.36	5.25
20	U	H6	19	C	H2'	2.01	3.15
20	U	H6	20	U	H1'	2.71	4.24
20	U	H6	20	U	H2'	2.84	4.62
20	U	H6	20	U	H3'	2.5	4.38
20	U	H6	20	U	H4'	2.5	4.38
21	G	H8	20	U	H1'	3.36	6
21	G	H8	20	U	H2'	2.05	4.5
21	G	H8	20	U	H3'	1.93	3.39
21	G	H8	21	G	H1'	3.12	5.07
21	G	H8	21	G	H2'	2.98	4.65
21	G	H8	21	G	H5''	2.5	5
22	C	H1'	21	G	H2'	3.89	6.08
22	C	H1'	22	C	H2'	2.25	3.51
22	C	H1'	22	C	H3'	2.4	3.9
22	C	H5	21	G	H2'	2.61	4.07
22	C	H5	22	C	H3'	2.8	4.37
22	C	H6	21	G	H1'	2.99	5
22	C	H6	21	G	H2'	1.95	3.16
22	C	H6	22	C	H1'	2.56	4.01
22	C	H6	22	C	H2'	2.98	4.65
22	C	H6	22	C	H3'	2.1	3.68
22	C	H6	22	C	H5	2.05	3.21
23	U	H5	22	C	H2'	2.61	4.07
23	U	H5	22	C	H3'	2.68	4.18
23	U	H5	23	U	H2'	4.65	7.26
23	U	H6	22	C	H1'	3.12	5.07
23	U	H6	22	C	H2'	1.97	3.08
23	U	H6	22	C	H3'	2.45	3.82
23	U	H6	22	C	H5	3.81	5.95
23	U	H6	23	U	H1'	2.6	4.07
23	U	H6	23	U	H2'	2.39	3.73
23	U	H6	23	U	H5	2.06	3.22
24	G	H1'	24	G	H2'	2.27	3.55
24	G	H1'	24	G	H3'	3.38	5.28
24	G	H8	23	U	H1'	2.79	4.88
24	G	H8	23	U	H2'	1.97	3.08
24	G	H8	23	U	H5	3.01	4.71
24	G	H8	24	G	H1'	3.16	4.93
24	G	H8	24	G	H3'	2.51	3.93
25	U	H1'	25	U	H3'	2.72	4.25
25	U	H1'	25	U	H4'	2.72	4.25

25	U	H3'	25	U	H5	3.12	5.07
25	U	H5	24	G	H2'	3.65	5.93
25	U	H5	24	G	H3'	3.65	5.93
25	U	H6	24	G	H1'	3.03	4.73
25	U	H6	24	G	H2'	1.87	2.92
25	U	H6	24	G	H3'	2.39	3.73
25	U	H6	25	U	H1'	2.7	4.72
25	U	H6	25	U	H2'	2.8	4.37
25	U	H6	25	U	H3'	1.93	3.39
25	U	H6	25	U	H5	2	3.12
25	U	H6	25	U	H5''	2.71	4.24
26	C	H1'	25	U	H2'	2.9	4.53
26	C	H1'	26	C	H2'	1.99	3.11
26	C	H1'	26	C	H3'	2.4	3.9
26	C	H3'	26	C	H2'	1.79	2.8
26	C	H5	25	U	H2'	2.85	4.46
26	C	H5	25	U	H3'	3.31	5.17
26	C	H5	25	U	H6	2.67	4.67
26	C	H5	26	C	H2'	3.26	5.1
26	C	H5	26	C	H3'	3.04	4.76
26	C	H6	25	U	H1'	3.43	5.36
26	C	H6	25	U	H2'	1.83	2.86
26	C	H6	25	U	H3'	2.15	3.77
26	C	H6	26	C	H1'	2.48	3.87
26	C	H6	26	C	H2'	2.38	3.72
26	C	H6	26	C	H3'	1.89	2.95
26	C	H6	26	C	H5''	2.79	4.35
27	**3**	C15	19	C	H5	2.81	6
27	**3**	C15	19	C	H6	3	7
27	**3**	C15	20	U	H1'	3	7
27	**3**	C15	20	U	H6	3	7
27	**3**	C15	21	G	H1'	3	7
27	**3**	C7	6	C	H1'	3	7
27	**3**	C7	6	C	H2'	3	7
27	**3**	C7	7	U	H1'	3	7
27	**3**	C7	7	U	H4'	3	7
27	**3**	C7	7	U	H6	3	7
27	**3**	H2	6	C	H1'	3	7
27	**3**	H2	6	C	H2'	3	7
27	**3**	H2	6	C	H5	3	7
27	**3**	H6	19	C	H1'	3	7
27	**3**	H6	19	C	H5	3	7
27	**3**	H6	20	U	H1'	3	7
27	**3**	H6	20	U	H2'	3	7
27	**3**	H6	21	G	H2'	3	7
27	**3**	H7	19	C	H1'	3	7
27	**3**	H7	19	C	H2'	3	7
27	**3**	H7	20	U	H2'	3	7
27	**3**	H7	20	U	H6	3	7
27	**3**	H7	21	G	H2'	3	7
27	**3**	H8	19	C	H1'	3	7

27	**3**	H8	19	C	H2'	3	7
27	**3**	H8	20	U	H1'	3	7
27	**3**	H8	20	U	H2'	3	7

Table S8: ^{1}H NMR chemical shifts of the unbound r(CUG) duplex.

Residue	H1′	H2′	H3′	H4′	H2/H5	H6/H8	H1/H3	H21/41/61, H22/42/62 amino
G1	5.709	4.831	4.654	-	n/a	8.052	12.59	-
A2	6.073	4.518	-	4.636	7.832	8.188	n/a	-
C3	5.424	4.321	4.515	4.413	5.209	7.605	n/a	8.272, 6.953
A4	5.882	4.555	4.716	4.480	7.026	7.973	n/a	-
G5	5.613	4.348	4.457	-	n/a	7.298	13.47	-
C6	5.461	4.293	-	-	5.143	7.475	n/a	8.341, 6.649
U7	5.475	4.294	-	-	5.462	7.606	10.3	n/a
G8	5.770	4.532	4.636	-	n/a	7.826	13.24	-
C9	5.513	4.352	4.435	-	5.231	7.761	n/a	8.586, 6.847
U10	5.517	4.648	4.604	-	5.438	7.936	13.57	n/a
G11	5.771	4.418	4.564	4.479	n/a	7.737	12.61	-
U12	5.479	4.226	4.464	-	5.105	7.800	14.62	n/a
C13	5.830	3.968	4.181	-	5.635	7.740	n/a	8.424, 7.035

Chemical shifts are reported in ppm units. Non-exchangeable protons were assigned at 25 °C. Exchangeable protons were assigned at 5 °C.

Table S9: ^{1}H NMR chemical shifts of r(CUG)-**1** complex.

^{1}H NMR chemical shifts of RNA in the r(CUG)-**1** complex:

Residue	H1′	H2′	H3′	H4′	H2/H5	H6/H8	H1/H3	H21/41/61, H22/42/62 amino
G1	5.667	4.809	-	4.389	n/a	8.027	12.61	-
A2	6.060	4.524	4.751	-	7.819	8.149	n/a	-
C3	5.424	4.328	4.499	-	5.206	7.581	n/a	8.307, 6.975
A4	5.890	4.556	4.709	4.485	7.050	7.960	n/a	-
G5	5.608	4.337	-	-	n/a	7.266	13.50	-
C6	5.492	4.273	4.308	-	5.131	7.442	n/a	8.372, 6.686
U7	5.505	4.256	-	-	5.442	7.590	-	n/a
G8	5.711	4.556	4.606	-	n/a	7.799	13.29	-
C9	5.529	4.371	4.441	-	5.226	7.718	n/a	8.610, 6.873
U10	5.534	-	-	-	5.412	7.921	13.61	n/a
G11	5.779	4.427	4.563	-	n/a	7.751	12.64	-
U12	5.486	4.211	4.462	-	5.106	7.781	14.64	n/a
C13	5.826	3.948	4.146	-	5.603	7.707	n/a	8.455, 7.085

^{1}H NMR chemical shifts of **1** in the r(CUG)-**1** complex:

Hydrogen	Chemical shift
H1/H2	7.236
H3/H4	7.318
H5/H6	8.010
H7/H8	7.297

Chemical shifts are in ppm units. Non-exchangeable protons were assigned at 35 °C. Exchangeable protons were assigned at 6 °C.

Table S10: ^{1}H NMR chemical shifts of r(CUG)-**2** complex.

^{1}H NMR chemical shifts of RNA in the r(CUG)-**2** complex:

Residue	H1′	H2′	H3′	H2/H5	H6/H8	H1/H3	H21/41/61, H22/42/62 amino
G1	5.631	4.753	-	n/a	8.021	-	-
A2	6.021	4.494	4.739	7.770	8.146	n/a	-
C3	5.384	4.298	4.490	5.179	7.552	n/a	8.194, 6.873
A4	5.854	4.542	4.674	6.996	7.928	n/a	-
G5	5.565	4.244	4.394	n/a	7.217	13.37	-
C6	5.525	4.199	4.344	4.986	7.358	n/a	-
U7	5.534	4.181	-	5.531	7.715	10.41	n/a
G8	5.658	4.324	-	n/a	7.725	-	-
C9	5.498	4.333	4.415	5.175	7.707	n/a	8.510, 6.725
U10	5.503	-	-	5.337	7.886	13.52	n/a
G11	5.738	4.388	4.537	n/a	7.715	12.50	-
U12	5.464	4.179	4.425	5.023	7.741	14.44	n/a
C13	5.785	3.955	4.140	5.541	7.658	n/a	-

^{1}H NMR chemical shifts of **2** in the r(CUG)-**2** complex:

Hydrogen	Chemical shift
H1/H2	7.555
H3/H4	7.641
H5/H6	7.997
H7/H8	7.725

Chemical shifts are in ppm units. Non-exchangeable protons were assigned at 35 °C. Exchangeable protons were assigned at 6 °C.

Table S11: ^{1}H NMR chemical shifts of r(CUG)-**3** complex.

^{1}H NMR chemical shifts of RNA in the r(CUG)-**3** complex:

Residue	H1′	H2′	H3′	H4′	H2/H5	H6/H8	H1/H3	H21/41/61, H22/42/62 amino
G1	5.627	4.755	4.627	4.377	n/a	7.962	12.39	-
A2	6.038	4.485	4.767	4.531	7.811	8.161	n/a	-
C3	5.425	4.318	4.521	4.402	5.179	7.627	n/a	8.247, 6.893
A4	5.882	4.548	4.717	4.473	7.041	7.963	n/a	-
G5	5.597	4.322	4.443	4.407	n/a	7.270	13.45	-
C6	5.500	4.247	4.346	4.350	5.128	7.445	n/a	8.316, 6.642
U7	5.561	4.278	4.467	4.382	-	7.642	10.09	n/a
G8	5.633	4.529	-	-	n/a	7.802	13.20	-
C9	5.526	4.354	4.443	-	5.192	7.764	n/a	8.555, 6.787
U10	5.530	4.626	-	-	5.364	7.953	13.61	n/a
G11	5.775	4.421	4.580	4.476	n/a	7.761	12.60	-
U12	5.475	4.202	4.464	4.377	5.117	7.795	14.60	n/a
C13	5.828	3.924	4.165	4.442	5.631	7.746	n/a	8.360, 7.027

^{1}H NMR chemical shifts of **3** in the r(CUG)-**3** complex:

Hydrogen	Chemical shift
H1	8.718
H2	8.060
H3	7.814
H4	6.735
H5	6.886
H6	6.919
H7	7.383
H8	6.950
H15/16/17	2.489
H18/19/20	3.770

Chemical shifts are in ppm units. Non-exchangeable protons were assigned at 35 °C. Exchangeable protons were assigned at 5 °C.

SYNTHETIC METHODS

Abbreviations. Boc, tert-butoxycarbonyl; DIPEA, diisopropylethylamine; DMF, *N*, *N*-dimethylformamide; Hex, hexanes; EtOAc, ethyl acetate; DMSO, dimethylsulfoxide; DCM, dichloromethane; DMAP, dimethylaminopyridine; EDCI, 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide;MeOH, methanol; NBS, *N*-bromosuccinimide; Rf, retention factor; TEA, triethylamine; TFA, trifluoroacetic acid; TLC, thin layer chromatography

General. Note the syntheses of compounds **1**[3] and **3**[4] were previously reported. The following were purchased from Acros Organics: 4-formylbenzoic acid, diethylenetriamine, and 4-nitrobenzaldehyde. *N*, *N*-dimethylformamide (DMF, anhydrous) was purchased from EMD and used without further purification. Claricep S-series prepacked silica columns were purchased from Agela-Technologies.

Flash chromatography was carried out on a Biotage Isolera One Automated Flash Chromatography System with prepacked Claricep S-series (40-60 μm). Normal-phase flash columns of various sizes were used.

Preparative HPLC was performed using a Waters 1525 Binary HPLC pump equipped with a Waters 2487 dual absorbance detector system and a Waters Sunfire C18 OBD 5 μm, 19 x 150 mm S-14 column. Absorbance was monitored at 254 nm and 345 nm. A linear gradient with a flowrate of 5 mL/min from 0-100% methanol in water with 0.1% (v/v) TFA over 100 min was used for small molecule purification. Purity was assessed by an analytical HPLC using a Waters Symmetry C18 5 μm, 4.6 x 150 mm column with a flow rate of 1 mL/min and a linear gradient from 0-100% methanol in water with 0.1% (v/v) TFA over 60 min. Absorbance was monitored at 254 nm and 345 nm.

^{1}H NMR spectra were collected on a Bruker 400 MHz NMR spectrometer. Mass spectra were recorded on a 4800 plus MALDI-TOF/TOF analyzer mass spectrometry an α-cyano-4-

hydroxycinnamic acid matrix. The concentration was determined in water using a molecular extinction coefficient (22501 M-1 cm-1 at 290 nm).

Synthesis of compound 2:

Scheme 1: Synthetic method for compound **2**.

***Tert*-butyl 2-(4-(4-formylbenzamido)phenyl)-4,5-dihydro-1*H*-imidazole-1-carboxylate (S3)**: 4-carboxybenzaldehyde (**S1**; 0.5 g, 3.33 mmol), tert-butyl 2-(4-aminophenyl)-4,5-dihydro-1H-imidazole-1-carboxylate (**S2**, synthetic methods below; 0.783 g, 3 mmol) , EDCI (0.958 g, 5 mmol) and DMAP (0.008 g, 2 mol%) were stirred at room temperature in DCM (15 mL) for 12 h. After the reaction was complete as monitored by TLC, the compound was purified by flash chromatography using Hex/EtOAc. In brief, the column was prepared with 50:50 Hex/EtOAc + 1% (v/v) TEA, and the solvent strength was increased to 10:90 Hex/EtOAc + 1% (v/v) TEA. Compound **S3** was obtained as a white colored solid in 22% yield (0.290 g, 0.737 mmol). ^{1}H NMR, $CDCl_3$ (400 MHz) δ: 1.32 (s, 9H, 9H, (CH_3)$_3$OCO), 3.90-4.02 (m, 4H, CH_2), 7.52-7.54 (d, 2H, Ar*H*), 7.66-7.69 (d, 2H, Ar*H*), 7.98-8.04 (m, 4H, Ar*H*), 8.24 (s, 1H, C*H*O), 10.11 (s, 1H, CON*H*).

4-(1-(2-aminoethyl)-4,5-dihydro-1*H*-imidazol-2-yl)-N-(4-(4,5-dihydro-1*H*-imidazol-2-yl)phenyl)benzamide (2): Compound **S3** (0.275 g, 0.699 mmol) was dissolved in DCM (15 mL) to which tert-butyl (2-((2-aminoethyl)amino)ethyl)carbamate (**S4** (synthetic methods below); 0.170 g, 0.839 mmol) was added, and the reaction was stirred at room temperature for 3 h. After 3 h, NBS (0.162 g, 0.909 mmol) was added and stirred overnight at room temperature. A new spot was observed by TLC (10:1 DCM/MeOH with 5% (v/v) TEA). The crude reaction mixture was then treated with 30% (v/v) TFA/DCM for 4 h. The solvent was evaporated, and compound was purified using reverse phase C18 column (solvent A: Water + 0.1% (v/v) TFA; solvent B: Methanol + 0.1% (v/v) TFA) to obtain **2** (TFA salt) as a pale white colored solid in 24% yield over 2 steps (0.120 g, 0.167 mmol). ^{1}H NMR, DMSO-*d6* (400 MHz) δ: 4.07 (s, 8H, C*H*$_2$), 7.67-7.69 (d, 2H, Ar*H*), 8.01 (s, br, 2H, N*H*$_2$), 8.06-8.12 (m, 4H, Ar*H*), 8.21-8.23 (d, 2H, Ar*H*), 10.61 (s, 1H, N*H*), 10.77 (S, 2H, N*H*), 10.97 (S, 1H, CON*H*).

Scheme 2

Scheme 2: Synthetic method for intermediate **S4**.

2-(4-nitrophenyl)-4,5-dihydro-1*H*-imidazole (S7): 4-nitrobenzaldehyde (**S6**; 1.5 g, 9.93 mmol) was added to a round bottom flask, to which ethylenediamine (0.716 g, 11.9 mmol) was added in *t*-BuOH (40 mL). The reaction mixture was stirred at room temperature for 30 min, after which K_2CO_3 (4.12 g, 29.78 mmol) and iodine (3.15 g, 12.41 mmol) were added. The reaction was

stirred at 70 °C for 3 h and then brought to room temperature. Sodium sufite solution was added to quench excess iodine. An orange-colored compound precipitated, which was filtered, washed with water and ether, and dried overnight. Compound **S7** was obtained as a dark orange colored solid in 95% yield (1.81g, 9.47 mmol). ^{1}H NMR, DMSO-*d6* (400 MHz) δ: 3.43-3.48 (t, 2H, CH_2), 3.84-3.89 (t, 2H, CH_2), 7.20 (s, 1H, N*H*), 8.06-8.08 (d, 2H, Ar*H*), 8.28-8.31 (d, 2H, Ar*H*).

***Tert*-butyl 2-(4-nitrophenyl)-4,5-dihydro-1*H*-imidazole-1-carboxylate (S8)**: Compound **S7** (1.2 g, 6.28 mmol), boc anhydride (2.05 g, 9.41 mmol), and TEA (0.953 g, 9.41 mmol) were added to DMF (20 mL) in a round bottom flask and stirred at room temperature for 4 h. Once the reaction was complete as monitored by TLC, water was added, which resulted in precipitation of a pale-yellow colored solid. The solid was filtered and dried overnight. Compound **S8** was obtained as a pale yellow colored solid in 84% yield (1.63g, 5.25 mmol). Rf = 0.7 (10:1 DCM/MeOH). ^{1}H NMR, DMSO-*d6* (400 MHz) δ: 1.20 (s, 9H, (CH_3)$_3$OCO), 3.91 (s, 4H, CH_2), 7.73-7.76 (d, 2H, Ar*H*), 8.25-8.28 (d, 2H, Ar*H*).

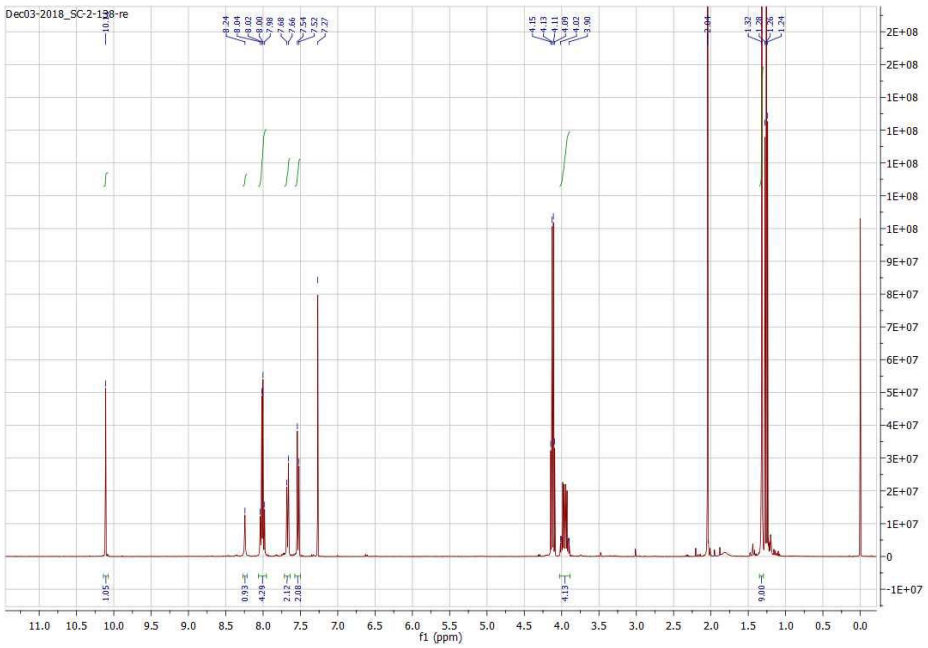
***Tert*-butyl 2-(4-aminophenyl)-4,5-dihydro-1*H*-imidazole-1-carboxylate (S2)**: Pd/C (0.1 g) was added to the hydrogenation vessel followed by addition of EtOH (5 mL). Compound **S8** (1 g, 3.43 mmol) was added next to the reaction vessel followed by addition of 20 mL EtOH. The reaction was carried out at room temperature under 10 atm pressure for 3 h. The reaction mixture was filtered through a plug of celite and washed with methanol to ensure maximum recovery of product. Solvent was evaporated to give pale white colored solid in 92% yield. (0.823 g, 3.15 mmol). ^{1}H NMR, DMSO-*d6* (400 MHz) δ: 1.26 (s, 9H, (CH_3)$_3$OCO), 3.68-3.73 (m, 2H, CH_2), 3.79-3.84 (m, 2H, CH_2), 5.43 (s, 2H, NH_2), 6.49-6.51 (d, 2H, Ar*H*), 7.15-7.17 (d, 2H, Ar*H*).

***Tert*-butyl (2-((2-aminoethyl)amino)ethyl)carbamate (S4)**: Diethylenetriamine (**S9**; 3 g, 29.08 mmol) was dissolved in dioxane (40 mL) and stirred at room temperature for 10 min. Boc

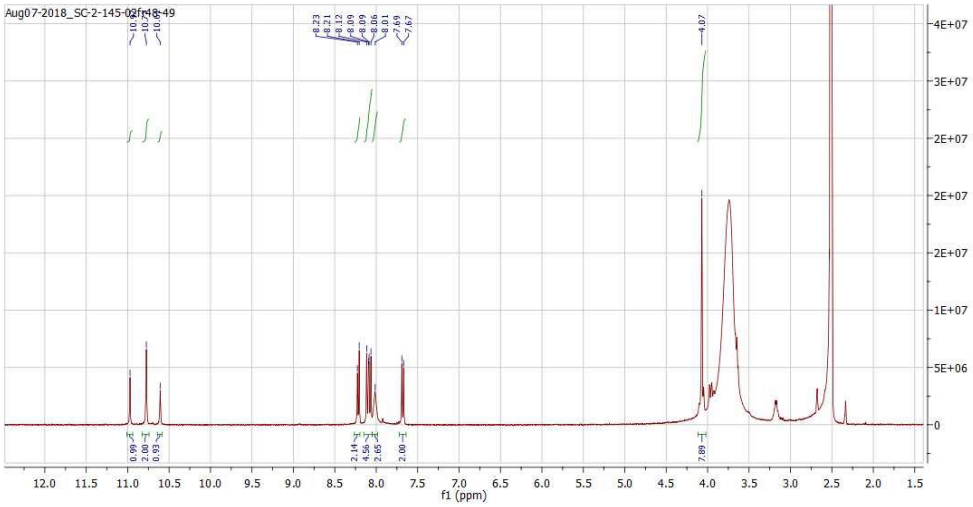
anhydride (0.825 g, 3.78 mmol) was dissolved in 20 mL dioxane and slowly added to the solution of diethylenetriamine and stirred at room temperature for 24 h. After the completion of reaction, the dioxane was evaporated, and the residue was dissolved in water and extracted with DCM (20 mL× 3). The pooled fractions were dried over Na_2SO_4 and evaporated to give crude intermediate **S4** (17% crude yield) as white oily liquid (1 g, 4.92 mmol). The compound was used without further purification. ^{1}H NMR, $CDCl_3$ (400 MHz) δ: 1.45 (s, 9H, $(CH_3)_3OCO$), 2.66-2.69 (t, 2H, CH_2NH_2), 2.72-2.75 (t, 2H, $NH_2CH_2CH_2NH$), 2.79-2.81 (t, 2H, $NHCH_2CH_2NHBoc$), 3.21-3.25 (q, 2H, $NHCH_2CH_2NHBoc$).

NMR Spectra for 2 and intermediates thereof:

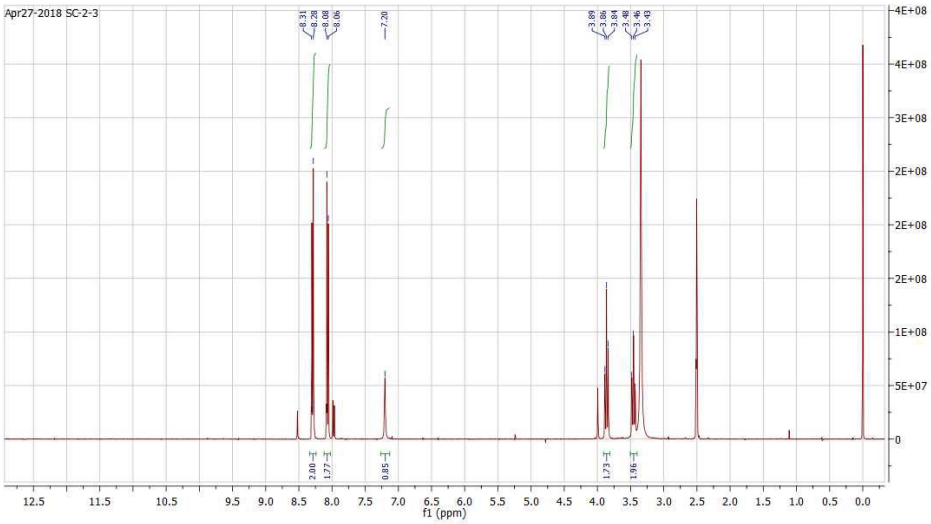
^{1}H NMR spectrum of compound **S3:**



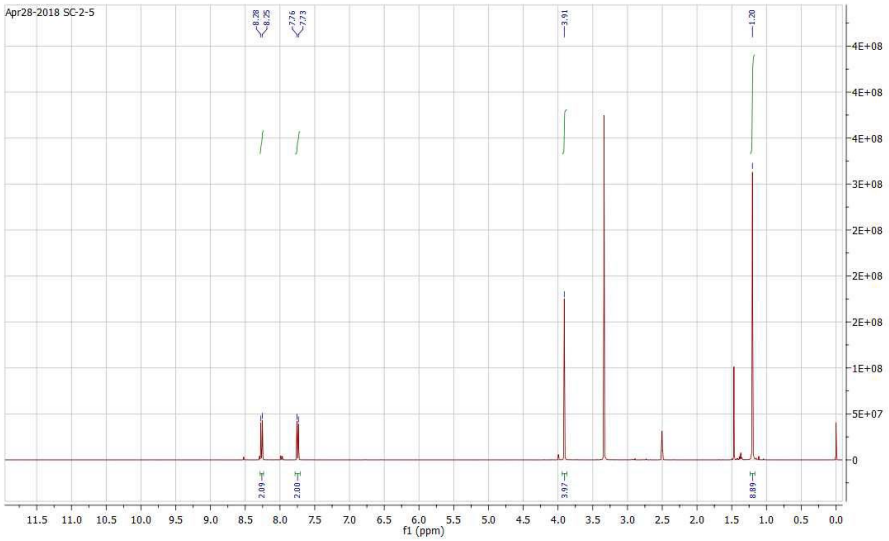
^{1}H NMR spectrum of compound **2**:



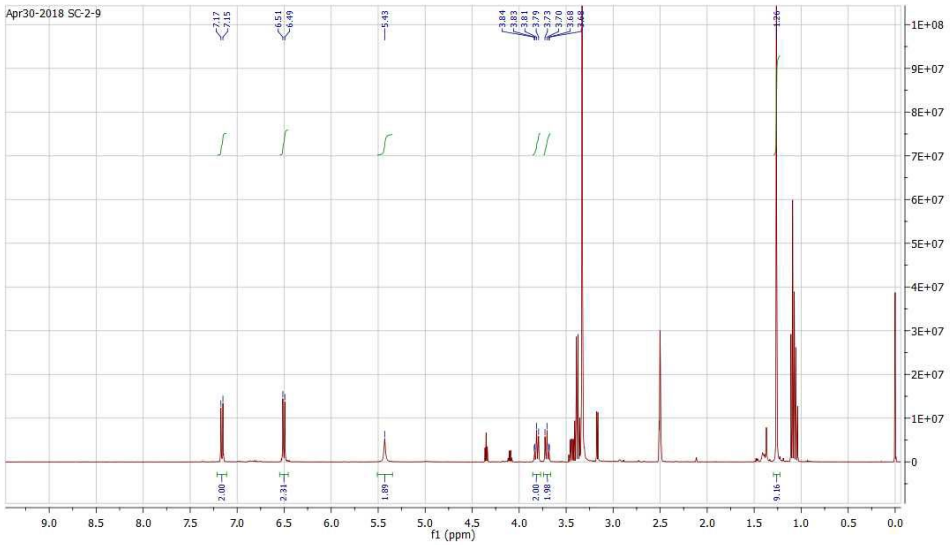
^{1}H NMR spectrum of compound **S7**:



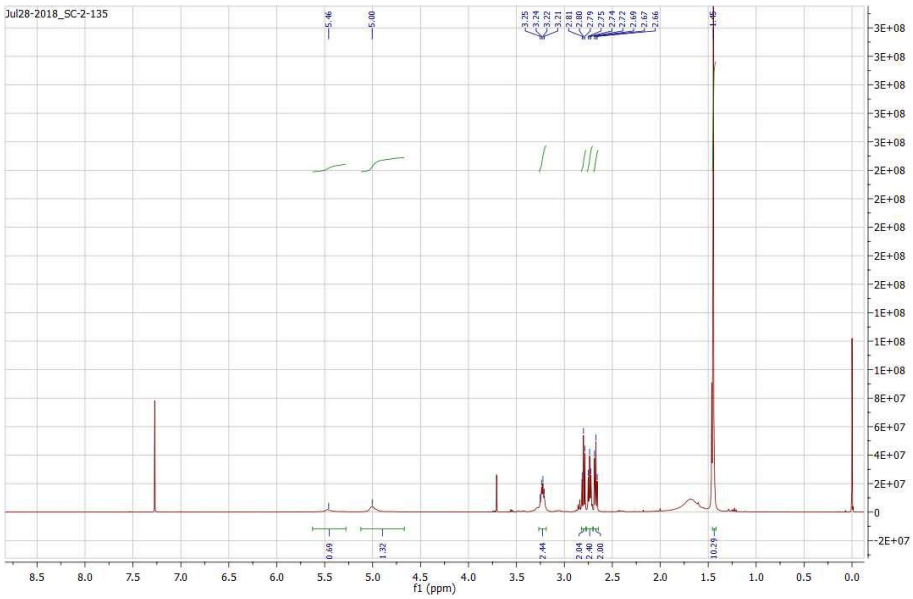
^{1}H NMR spectrum of compound **S8**:



^{1}H NMR spectrum of compound **S2**:



^{1}H NMR spectrum of compound **S4**:



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