Supplementary Information

High-throughput dissection of the thermodynamic and conformational properties of a ubiquitous class of RNA tertiary contact motifs

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SI Methods

Library design, synthesis, amplification, and sequencing. The DNA library was prepared following protocols described previously (1-4). Briefly, we designed a sequence library (n = 19,930) of tectoRNA constructs flanked by common sequences for PCR amplification. The library was pooled with sequences for other experiment (not discussed here) and synthesized in duplicate in a 90,000-scale oligo synthesis by CustomArray. To ensure a uniform oligo length of 130 nts, shorter sequences were "padded" with a random sequence at the 3′ end. To eliminate incomplete products from the synthesis, the oligos were PCR amplified using internal primers (Oligopool_left and Oligopool_right; Table S4) that hybridized to common flanking sequences. The PCR amplification reaction contained 1:400 dilution of the oligo synthesis, 200 nM of each primer, 200 mM dNTPs, 3% DMSO, 1X Phusion HF buffer, 0.01 U/ml of HS Phusion DNA polymerase (NEB M0535). The reaction was performed for 9 cycles (98°C for 10 seconds, 62°C for 30 seconds, and 72°C for 30 seconds). The products of the PCR reaction were purified by agarose gel electrophoresis, cleaned up using a Qiagen PCR kit, and eluted in 20 μl of elution buffer. After the initial amplification, a five-piece PCR assembly was performed to append unique molecular identifiers (UMI) consisting of 16 random nucleotides and sequences required for Illumina sequencing. The PCR assembly reaction contained 1 μl from the previous reaction,137 nM of each of two outside primers (Short _C and Short_D; Table S4), 3.84 nM of each of two adaptor sequences (C1_R1_BC_RNAP and D-Read2; Table S4), 200 nM dNTPs, 3% DMSO, 1x Phusion HF buffer, and 0.02 U/ml of Phusion Hot Start Flex DNA polymerase (NEB). The reaction was performed for 14 cycles, with each cycle consisting of 98°C for 10

seconds, 63°C for 30 seconds, and 72°C for 30 seconds and was purified using the QIAquick PCR purification kit. We then bottlenecked the library to reduce the UMIs to ~700,000 unique sequences. To do this, the library was quantified against a standard PhiX library (Illumina, CA). First, the PhiX library was diluted in 0.1% Tweeen20 to obtain a standard curve ranging from 25 pM to 0.2 pM and the tectoRNA library was diluted 1:5000 in 0.1% Tween20. qPCR was then employed to determine the relative cycle thresholds (CT). The qPCR reaction contained 1.25 mM primers (Short_C and Short_D; Table S4), 0.6x SYBR green, fluorescent dye (ThermoFisher), 1x NEBNext Master Mix (NEB). The qPCR cycles consisted of 98°C for 10 seconds, 63°C for 30 seconds, and 72°C for 60 seconds. The concentration of the tectoRNA library was calculated using the CT values and a volume corresponding ~700,000 molecules was PCR amplified. This last PCR amplification included 1.25 mM Short_C, 1.25 mM Short_D primers, and 1x NEBNext PCR Master Mix and was cleaned up using a QIAquick PCR purification kit. Finally, the bottlenecked, amplified library was sequenced with an Illumina Myseq sequencer using three cycles: 75 bases in read 1, 75 bases in read 2, and an 8 bp i7 index read, as done previously (3). Myseq determines the sequence of DNA clusters by imaging the fluorescence generated by the serial integration of reversibly labeled 3′ terminated nucleotides; this imaging is performed in “tiles” that correspond to fields of view along the sequencing flow cell (1, 2). The tile information and the location of the clusters is reported along with the sequence of the clusters. As done previously (1-6), this information was used downstream to assign sequences to the fluorescent clusters observed in RNA-MaP, after the sequenced chip has been installed on the custom-built imaging station described below.

Preparation of fluorescent flow pieces. RNA flow pieces with GAAA and GUAA TLs (Mut2_GAAA and Mut2_GUAA, respectively; Table S4) were synthesized and HPLC-purified by Integrated DNA Technologies (IDT). The RNAs contained a 5′ amino-C6 modification for labeling with a Cy3b fluorescent dye. The labeling was done following an established protocol (7) and the products were purified by denaturing gel electrophoresis (8% acrylamide, 8M urea, and 1x TBE: 89 mM Tris-HCl, 89 mM boric acid, pH 7.4, and 2 mM sodium EDTA). The RNAs were eluted in water using the crush-and-soak method and the elution was cleaned up by spinning two times with Amicon Ultra-15 centrifugal filters (50kDa cutoff) in water, followed by a final spin with 3kDa-cutoff centrifugal filter. The concentrations of the flow pieces were measured using the Qubit RNA high sensitivity kit (ThermoFisher).

Imaging station. The sequenced Myseq chip was installed on a repurposed Ilumina GAIIx sequencer that was modified with a fluidics pump for delivery of reagents to the chip, an autosampler, a Peltier-based device for controlling experiment temperature, and a dual-color laser excitation system, as described previously (1, 2). The modified Illumina sequencer allows a variety of on-chip high-throughput quantitative biochemical measurements that are not possible using standard sequencers (1, 2, 8). The fluorescence on the surface of the flow cell was imaged using a TIRF setup with a red channel (660 nm laser; 664 nm long pass filter) and a green channel (530 nm laser; 590 nm band pass filter). Custom Matlab scripts were used to control the experiment temperature, fluidics (e.g., flow rate), laser power, and stage position.

On-chip generation of double-stranded DNA templates for RNA transcription. We followed protocols described previously (2-4), to transcribe tectoRNA from clusters of double-stranded DNA templates. This was done using a series of washes, oligo hybridizations, and enzymatic reactions performed on-chip using fluidics to deliver reagents to the surface. Reagents and buffers were delivered at 100 μl/min in 250 μl volumes, unless stated otherwise. First, the chip was washed with Cleavage buffer (100 mM Tris-HCl, 125 mM NaCl, 0.05% Tween20, 100 mM TCEP, pH 7.4) and the strands of DNA not covalently attached (remaining from the Myseq sequencing) were removed by washing with 100 % formamide at 55°C. To generate double stranded DNA templates, first we hybridized a 5′ biotinylated oligo primer (Biotin_D_Read2; Table S4) by incubating for 15 minutes at 60°C in Hybridization buffer (5x SSC (ThermoFisher 15557036), 5 mM EDTA, 0.05% Tween20), followed by lowering the temperature to 40°C and incubating by an additional 10 minutes. The biotin in the primer was used downstream to bind a streptavidin 'roadblock' that prevents multiple RNA polymerase (RNAP) molecules to transcribe from a single DNA template. After hybridization of the biotinylated primer, we washed with Annealing buffer (1x SCC buffer, 7 mM $MgCl_2$, and 0.01% Tween20) and with Klenow buffer (1x NEB buffer 2 (NEB B70002S), 250 mM each dNTP, 0.01% Tween20). To begin the generation of complementary DNA strands, we applied 150 μl (this volume corresponded to one fluidic line to the chip) of Klenow buffer with 0.1 U/μl Klenow fragment (NEB M0212), applied an addition 75 μl of Klenow buffer, and incubated at 37°C for 30 minutes. Then we washed with Hybridization buffer. To block remaining single-stranded DNA we hybridized a non-fluorescent oligo (Dark_stall; Table S4) complementary to constant stall sequence by incubating 500 nM

of the oligo for 10 minutes at 37°C. We then washed with Annealing buffer, repeated the hybridization of Dark_stall, and washed again with Anneling buffer. To confirm that no single-stranded DNA remained, we hybridized a fluorescent version of the oligo (Fluorescent_stall; Table S4) and image the chip to ensure that no significant fluorescence was observed.

On-chip RNA transcription. To create a roadblock for RNAP stalling, we bound streptavidin to the biotinylated primer used above by incubating with 1 μM streptavidin in Annealing buffer, washing with Annealing buffer, and incubating with 5 μM of biotin in Annealing buffer to saturate remaining biotin binding sites on the bound streptavidin molecules. The generation of RNA proceeded in three steps: initiation, stalling, and elongation. This was done to prevent multiple RNAP molecules to transcribe from the same DNA template. We first washed with Initiation buffer (2.5 μM each of GTP, ATP, and UTP in R-reaction buffer which consisted of 20 mM Tris-HCl pH 8.0, 7 mM $MgCl_2$, 20 mM NaCl, 0.1% BME, 0.1 mM EDTA, 1.5% glycerol, 0.02 mg/ml BSA, and 0.01% Tween20). Note that Initiation buffer does not contain CTP and therefore RNAP would stall transcription when incorporation of the first C is required. The stall sequence was designed such that only one RNAP could bind to the DNA template via steric blocking. Initiation began with the addition of 150 μl (one line) of 0.06 U/μl *E. coli* RNAP holoenzyme (NEB M0551) in Initiation buffer, followed by 75 μl of Initiation buffer. Transcription initiation proceeded for 10 minutes at 37°C. At this point one RNAP should be bound to each DNA template and be stalled by the lack of CTP. Excess RNAP was removed by washing with Initiation buffer. Extension began with addition of Extension

buffer (R-reaction buffer with 1 mM each NTP). Transcription proceeded for 10 minutes at 37°C.

tectoRNA binding measurements. Dissociation constants (K_d values) for each of the on-chip tectoRNA clusters binding to a common fluorescently-labeled "flow piece" were obtained by incubating the flow piece at a series of concentrations and measuring the change in fluorescence of the clusters. The flow piece was serially diluted in Binding buffer (89 mM Tris-Borate, pH 8.0, 0.01 mg/ml yeast tRNA, 0.01% Tween20, and variable concentrations of $MgCl_2$ and KCl; see main text). The flow piece concentrations were 0.91, 2.7, 8.2, 24.7, 74.1, 222, 667, and 2000 nM and the binding experiments were performed at 22°C. Incubations were allowed sufficient time to reach thermodynamic equilibrium, as determined in our previous experiments (3, 4). After equilibration, the clusters were imaged using fluorescence in the green and red channels across the tiles. In total, we performed five independent RNA-MaP experiments: GAAA TL flow piece (Mut2_GAAA; Table S4) with 30 mM $MgCl_2$ (2 replicates), 5 mM $MgCl_2$, and 5 mM $MgCl_2$ + 150 mM KCl, and GUAA TL flow piece (Mut2_GUAA; Table S4) with 30 mM $MgCl_2$.

Image processing and initial data processing. Tile information and cluster coordinates were extracted from the sequencing data and used to map the sequences to the images from the binding experiments using an iterative cross correlation analysis with sub-pixel resolution described previously (1). Because of differences in the optics of the Myseq and the customized RNA-MaP imaging station, the mapping required a series of image transformations and corrections (1, 2). After this mapping, the fluorescence

corresponding to each individual cluster was fit to a 2D Gaussian for quantification. For each cluster, the fluorescence corresponding to the bound tectoRNA flow piece (green channel) was normalized by the amount of transcribed RNA (red channel) to reduce inter-cluster variation in maximum fluorescence. Binding curves for each cluster were then obtained from the changes in fluorescence across flow piece concentrations using a robust statistical method described in detail in our previous studies of two-way junctions (3). Briefly, least-squares was used to fit the normalized fluorescence of each cluster to the following model

$$f(x) = f_{min} + f_{max} \frac{x}{x + \exp\left(\frac{\Delta G}{RT}\right)}$$

where *f(x)* is the normalized fluorescence as function of flow piece concentration, f_{min}, f_{max}, and ΔG are free parameters, x is the flow piece concentration, R is the gas constant, and T is temperature in Kelvin. After fitting each individual cluster, we grouped clusters corresponding to the same variant to obtain distributions of f_{min} and f_{max} and used the average of these distributions to refine the fits. As described and validated previously (3, 4), f_{max} for stable binders that saturated were used to obtain accurate ΔG values for weak variants that did not saturate. ΔG_{bind} values reported in the main text for each variant are medians across all clusters corresponding to that variant. Based on previous experiments (3), $\Delta G_{bind} > -7.1$ kcal/mol were considered less reliable. Variants that had fewer than five clusters were discarded for statistical rigor, as done previously (3). In the case for which there were two replicates, the ΔG_{bind} reported was the weighted average given by

$$\Delta G_{bind} = \left(\frac{\Delta G_1}{\sigma_1^2} + \frac{\Delta G_2}{\sigma_2^2}\right)\left(\frac{1}{\sigma_1^2} + \frac{1}{\sigma_2^2}\right)^{-1}$$

where ΔG_1 and ΔG_2 are the binding free energies for each of the two replications and $\sigma 1$ and $\sigma 2$ are the corresponding errors. The combined error is given by

$$\sigma = \left(\sqrt{\frac{1}{\sigma_1^2} + \frac{1}{\sigma_2^2}}\right)^{-1}$$

Simulation of thermodynamic fingerprints. To assess the effect that average stability can have on comparison between thermodynamic fingerprints, we simulated theoretically identical fingerprints at different stabilities and compared them using Pearson's correlation coefficients. To do this, we used the fingerprint of GAAA/11ntR_{wt} and added a series of constant offsets to generate a series of shifted fingerprints. To each theoretical data point we added error by sampling a normal distribution centered around the average error that average stability as calculated from the data across the entire library. Data points that fell outside of the stability threshold were not used in the calculation of the correlation coefficients.

Hierarchical clustering. In our hierarchical clustering of 11,060 mean-scaled stability values (1106 TLRs across 5 scaffolds and 2 TLs; Figure D-F) 16% of the values were missing. Missing values could occur for several reasons such as when not enough clusters of that variant were observed in the sequenced library or if the chip tectoRNA construct misfolded. In PCA and clustering analysis, the missing data had to be interpolated. To do this, for any missing value in a TLR fingerprint (each row in Figure

5D) we found the 15 most similar fingerprints that were within 0.2 kcal/mol mean absolute deviation (MAD) based only on values that were not missing. Missing data were then obtained by interpolation, using the median affinity of the similar fingerprints. After handling of missing data, we performed PCA using functions included in the 'scikit learn' Python package. The transformed values within the first two PCs (explaining >80% of the variance) were then hierarchically clustered using the Ward method implemented in Python.

Classification of natural TLR variants. To search for natural TLR variants we used sequence alignments contained within online databases of group I introns (9), group II introns (10), RNase P (11), and a published study of c-di-GMP riboswitches (12). TLRs were searched for in areas within the RNAs experimentally known to contain TL/TLR tertiary contacts. For group I introns, these locations were L5b-P6, L9-P5, and L2-P8. For group II introns we focused on the ζ-ζ′ TL/TLR between domains V and I. For RNase P we looked at L12-P10.1 and for c-di-GMP riboswitches at L2-P3.

Supplementary Figures and Tables

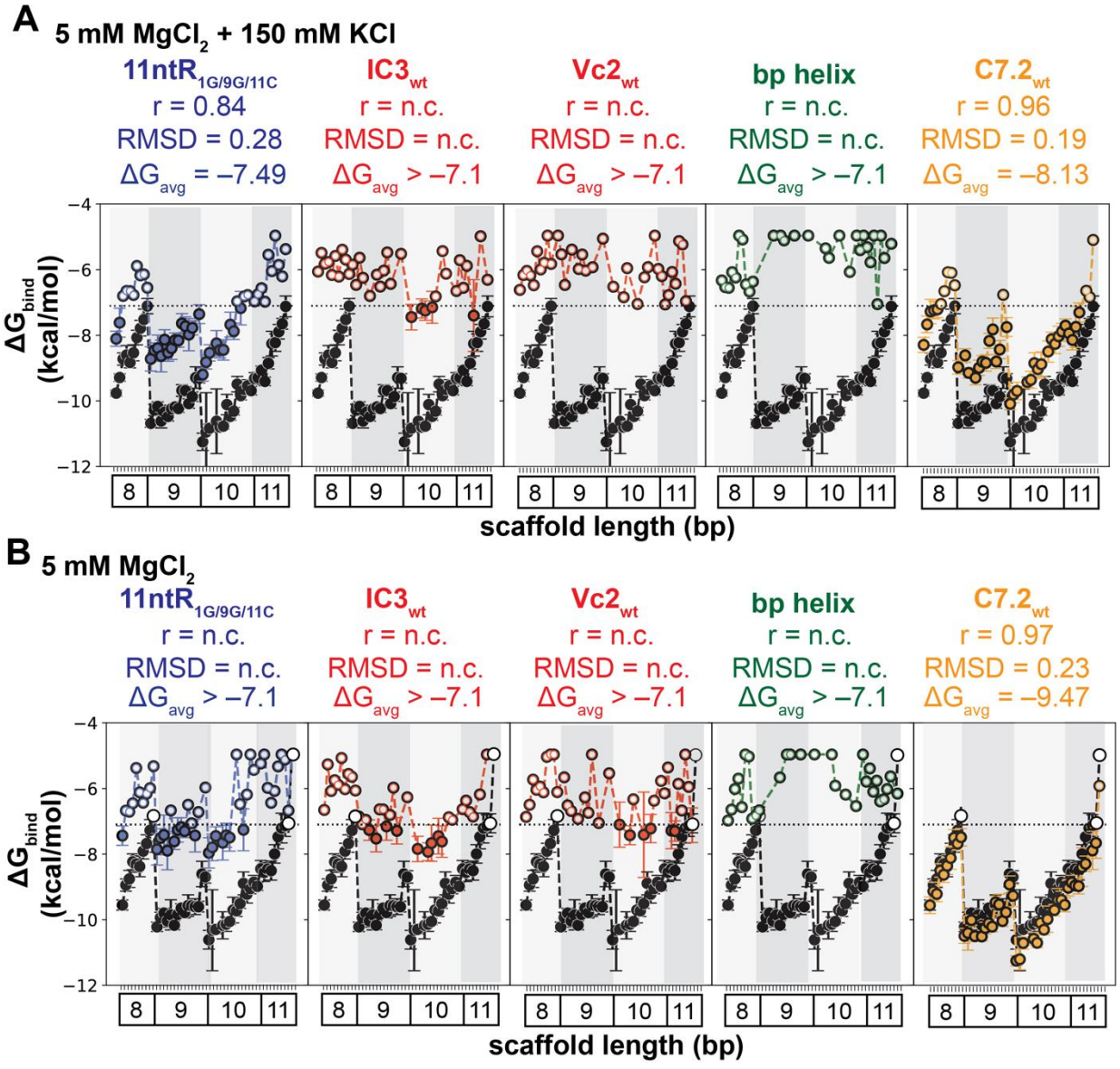


Figure S1. Thermodynamic fingerprints of representative TL/TLRs at different ionic conditions. ΔG_{bind} for TLRs binding to GAAA TL across scaffolds. Dashed grey line indicates threshold of –7.1 kcal/mol. Open symbols are ΔG_{bind} values above this threshold. Dashed colored lines are drawn to guide trend in thermodynamic fingerprints. To quantitatively compare the fingerprints, they were superimposed to that of GAAA/11ntR$_{wt}$ (black circles) by shifting them by a constant value and minimizing RMSD, and these minimal RMSD values are shown. Values above threshold were not used in the calculation of the correlation coefficient (r). ΔG_{avg} is the median. Comparisons to TLRs with ΔG_{avg} > –7.1 kcal/mol are not reliable and are RMS and r values were not calculated (n.c.). (A,B) Common solution conditions: 89 mM Tris-Borate, pH 8.0, 0.01 mg/ml yeast tRNA, 0.01% Tween20 with 5 mM $MgCl_2$ /150 mM KCl in (A) and 5 mM $MgCl_2$ in (B).

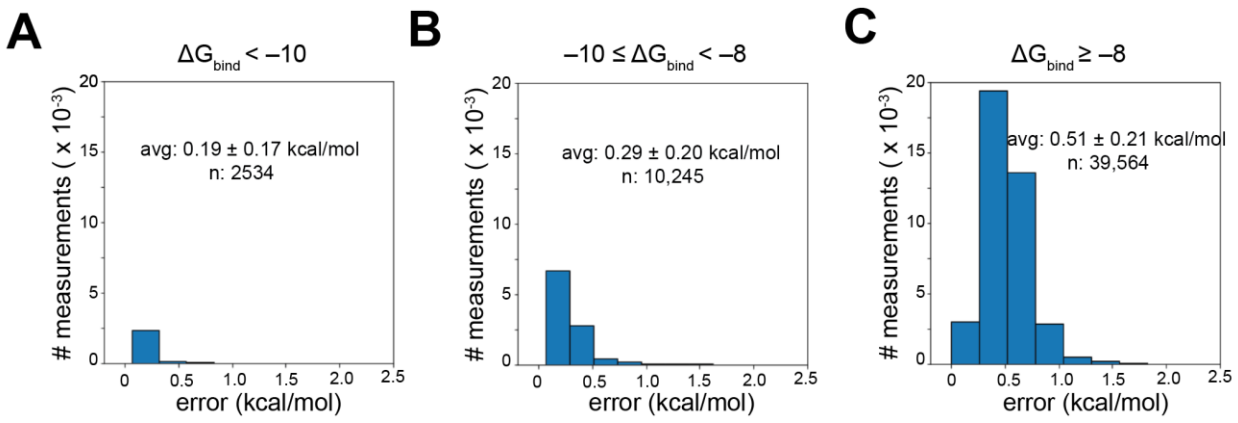


Figure S2. The average error in ΔG_{bind} measurements increases with decreasing stability. Distribution of measurement errors for stable binding (ΔG_{bind} < –10 kcal/mol, A), medium stability (–10 kcal/mol ≤ ΔG_{bind} < –8 kcal/mol, B) and low stablitiy (ΔG_{bind} ≥ –8 kcal/mol, C).

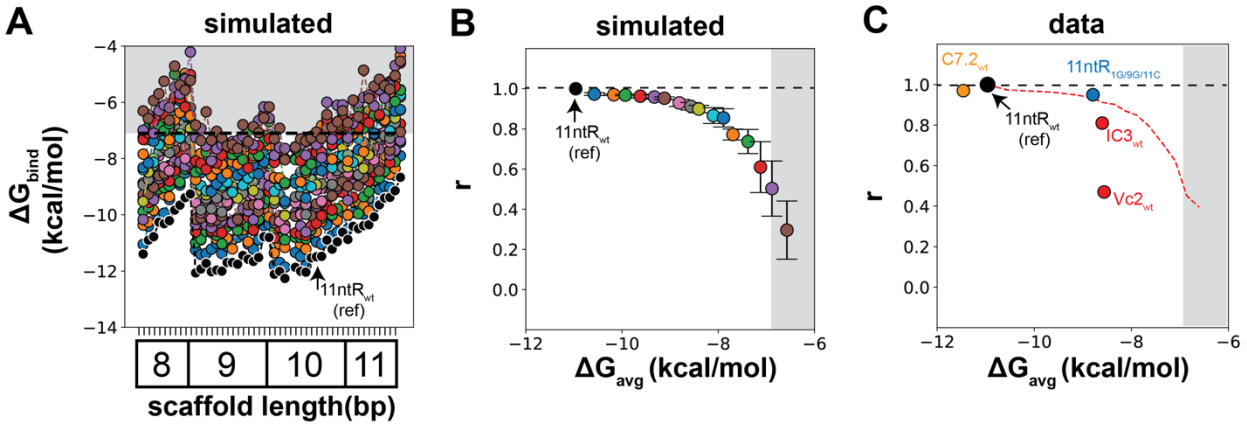


Figure S3. Effect of stability on the correlation of theoretically identical fingerprints. (A) To generate theoretically identical fingerprints at different average stabilities, a series of constant offsets were added to the fingerprint of GAAA/11ntR$_{wt}$ (black). To account for error on ΔG_{bind}, each value was taken from a normal distribution with a standard deviation equal to the average experimental error. Dashed line indicates the stability threshold of –7.1 kcal/mol. (B) Pearson's correlation coefficients (r) were calculated between the simulated fingerprints and that of the data for GAAA/11ntR$_{wt}$. Values > –7.1 kcal/mol are not used in the calculation of r. Shaded gray area indicates ΔG_{avg} > –7.1 kcal/mol. Dashed black line drawn at r = 1. (C) Correlation of representative TL/TLRs from Figure 4A. Red dashed line shows trend of r for theoretically identical fingerprints from part B. Shaded gray area indicates ΔG_{avg} > –7.1 kcal/mol. Dashed black line drawn at r = 1. Based on the simulations, the distinctions between GAAA/11ntR$_{wt}$ and GAAA/Vc2$_{wt}$ are not within error and therefore reflect real differences in the effect of the scaffolds.

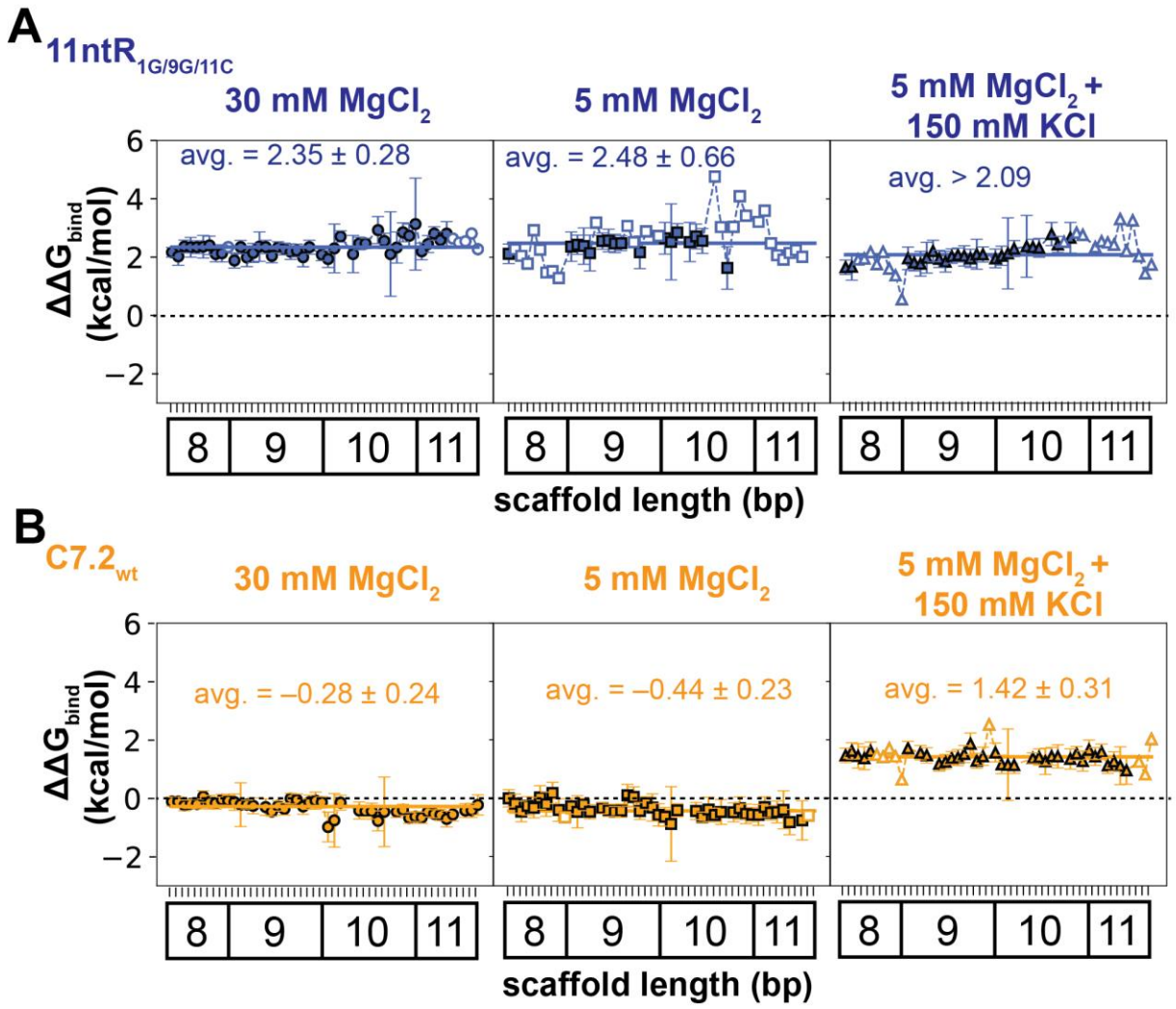
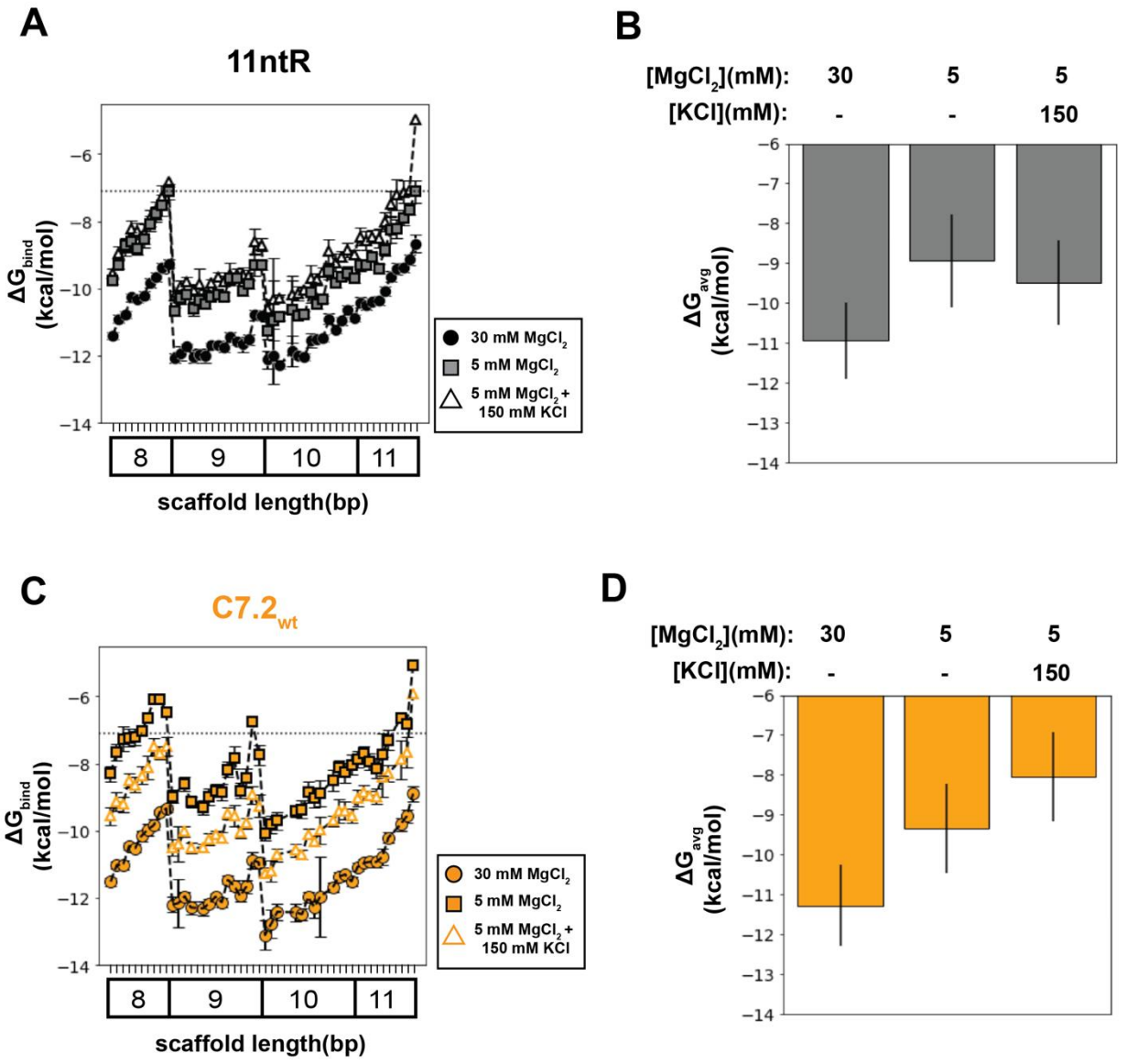


Figure S4. $\Delta\Delta G_{bind}$ **across scaffolds and ionic conditions for GAAA/11ntR$_{1G/9G/11C}$ and GAAA/C7.2$_{wt}$.** $\Delta\Delta G_{bind}$ values are relative to GAAA/11ntR$_{wt}$ and were measured under three different ionic conditions: (A) 30 mM $MgCl_2$, (B) 5 mM $MgCl_2$, and (C) 5 mM $MgCl_2$ + 150 mM KCl. Average values are medians and error reported are standard deviations. Open symbols are lower limits. For GAAA/11ntR$_{wt}$, which was used for all

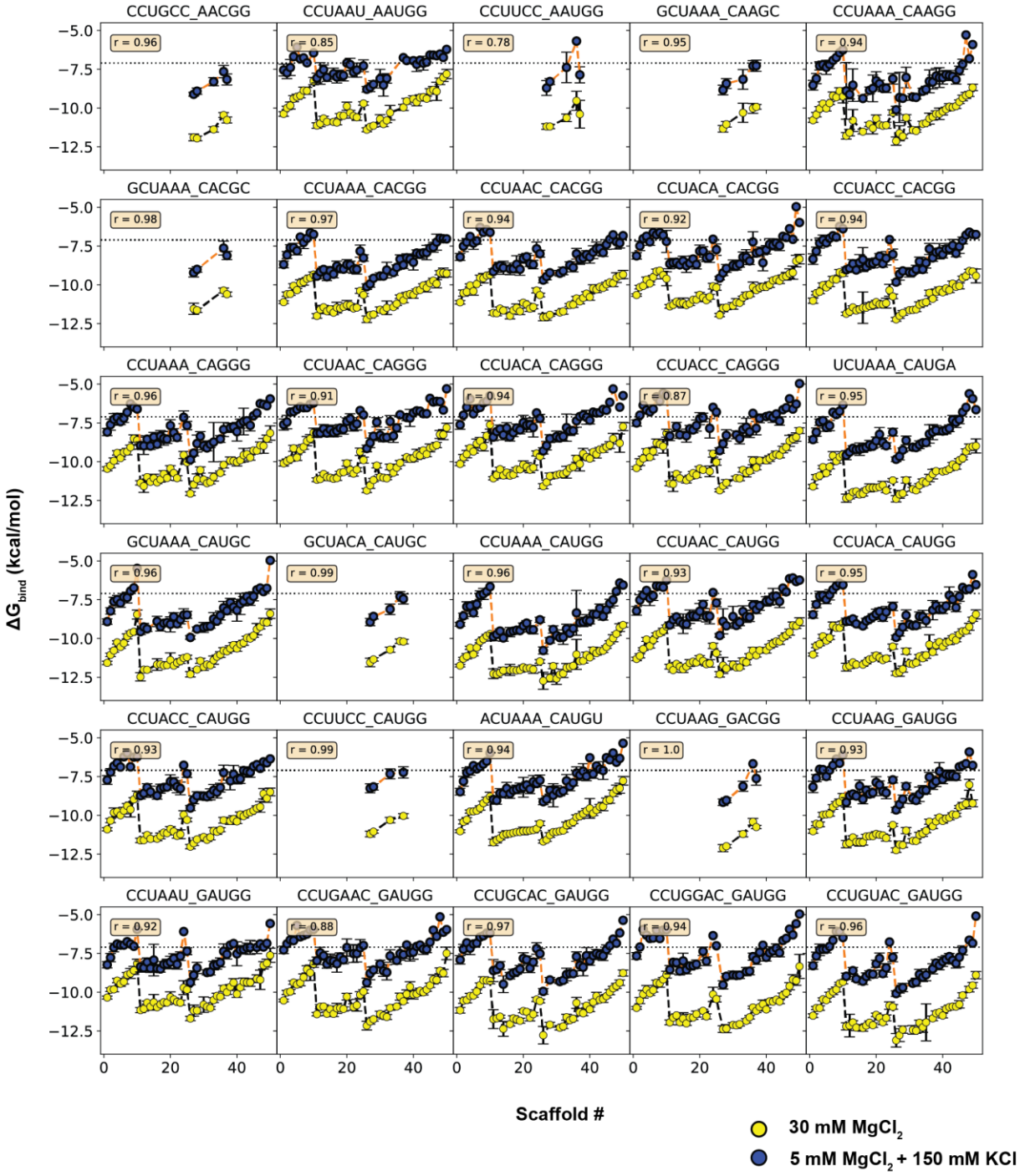
the comparisons to obtain $\Delta\Delta G_{bind}$ values, at 5 mM $MgCl_2$ there were three ΔG_{bind} values > –7.1 kcal/mol (black open symbols, Figure S3), sometimes resulting in undetermined $\Delta\Delta G_{bind}$ values because both ΔG_{bind} values being compared were limits; these cases were not included in determination of average $\Delta\Delta G_{bind}$.



308

309 **Figure S5. The shapes of the GAAA/11ntR$_{wt}$ and GAAA/C7.2$_{wt}$ thermodynamic**
310 **fingerprints are independent of ionic conditions.** (A) Thermodynamic fingerprint of
311 GAAA/11ntR$_{wt}$ at three different ionic conditions. (B) Average stability of GAAA/11ntR$_{wt}$
312 at three different ionic conditions. Addition of 150 mM KCl results in small increase in
313 the average stability of the TL/TLR. (C) Thermodynamic fingerprint of GAAA/C7.2$_{wt}$ at

three different ionic conditions. (D) Average stability of GAAA/C7.2$_{wt}$ at three different ionic conditions. Here addition of 150 mM KCl decreases the average stability.



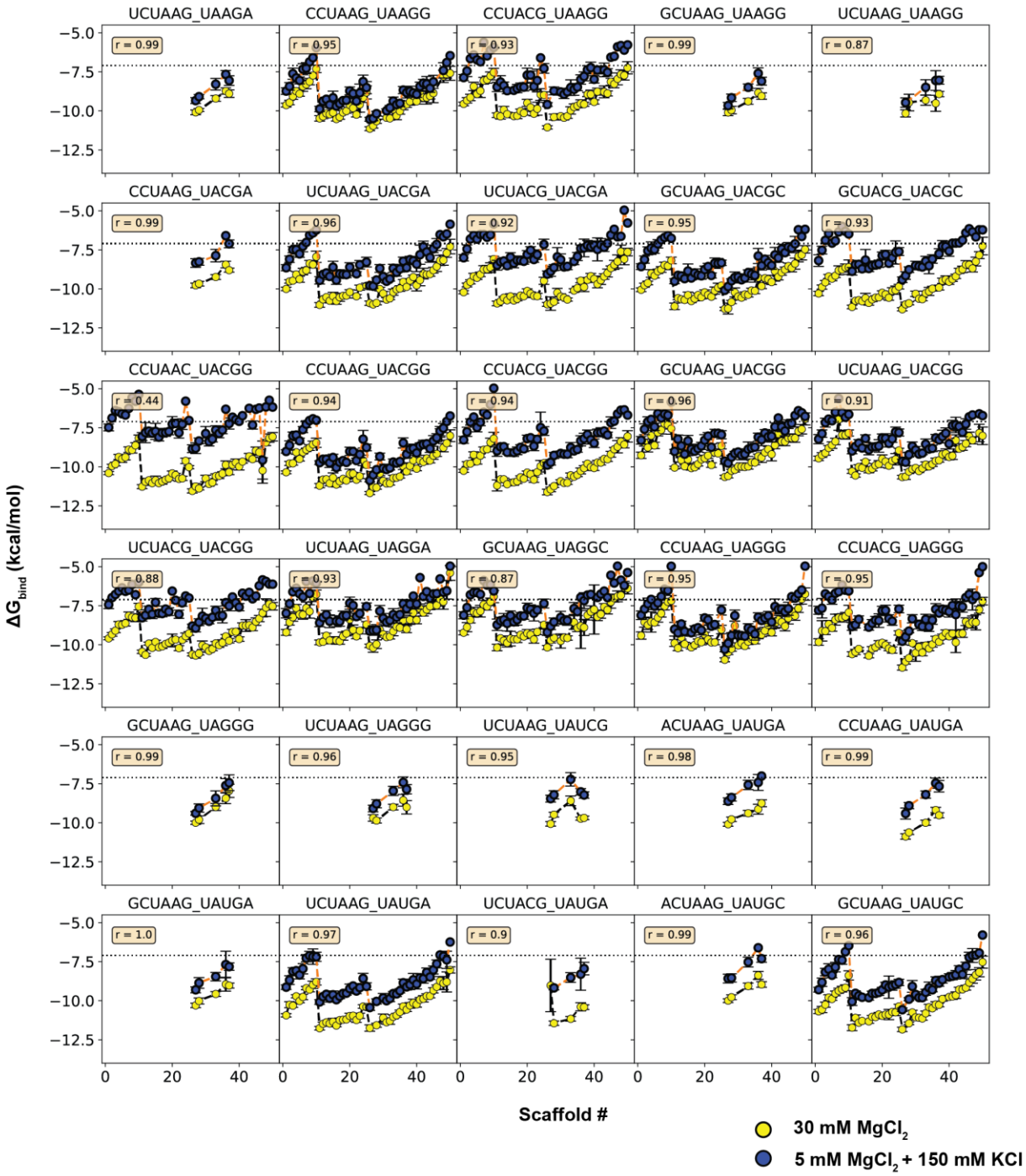
317

318 **Figure S6. Comparison of thermodynamic fingerprints across ionic conditions.**

319 TLRs included in this analysis are those in which the average stability was above

320 threshold both at 30 mM $MgCl_2$ and at 5 mM $MgCl_2$ + 150 mM KCl (n = 78 out of 1493

TLR sequences; the majority of TLRs were below the stability threshold at 5 mM $MgCl_2$ + 150 mM KCl). The sequence of the TLR is written above each plot. Dashed grey line indicates threshold of –7.1 kcal/mol. Correlation coefficients of data at 30 mM $MgCl_2$ *versus* 5 mM $MgCl_2$ + 150 mM KCl are shown.



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326 **Figure S6 (continued).**

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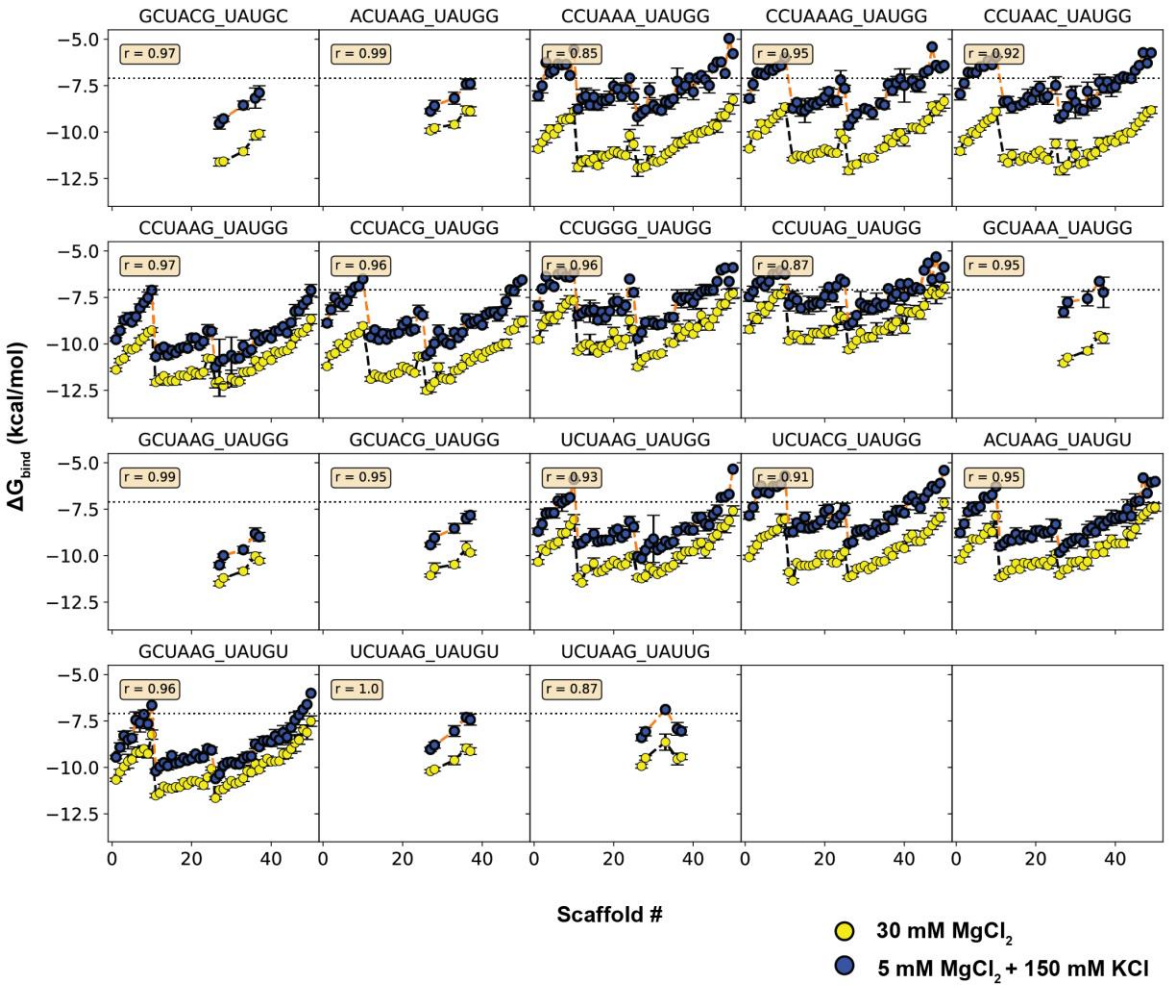


Figure S6 (continued).

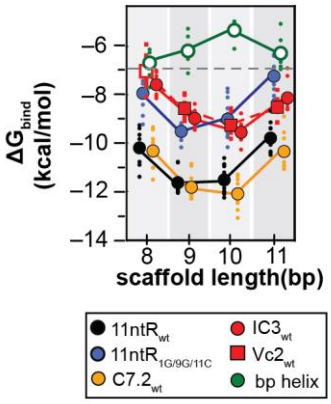
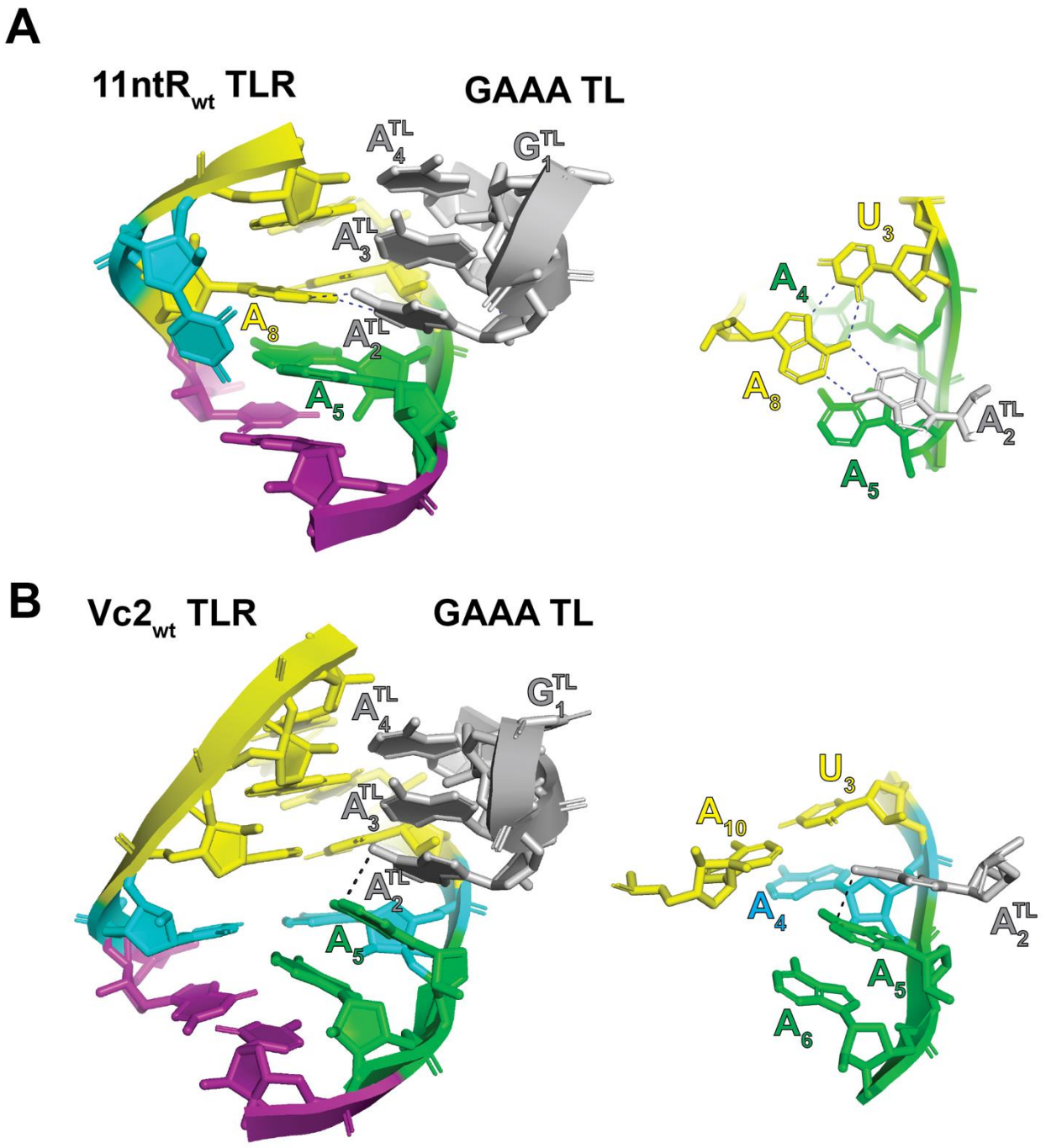


Figure S7. Representative TL/TLRs displayed different stability trends across scaffold lengths. ΔG_{bind} grouped by scaffold length (see also Figure 4A in main text). Large symbols are averages. Open symbols are above threshold of –7.1 kcal/mol indicated by the dashed grey line.



338

339 **Figure S8. Interactions between the second A of the TL differ between**
340 **GAAA/11ntR$_{wt}$ and GAAA/Vc2$_{wt}$.** (A) Crystal structure of the GAAA/11ntR$_{wt}$ in the
341 context of the *Tetrahymena* group I intron P4-P6 domain (PDB 1GID). Panel on the right
342 shows close up of interactions made by the second residue of the GAAA TL with the

11ntR$_{wt}$ TLR. The second residue of the TL makes a network of hydrogen-bond interactions with the U_3-A_8 bp, that is part of the core of the TL/TLR and critical to its tertiary stability. (B) Crystal structure of GAAA/Vc2$_{wt}$ in the context of the cyclic-di-GMP riboswitch (PDB 3IRW). Panel on the right shows close up of interactions made by the second residue of the GAAA TL with the Vc2$_{wt}$ TLR. In contrast to the sequence specific network of interactions made in the GAAA/11ntR$_{wt}$ TL/TLR, the second residue of the TL makes a single hydrogen-bond interaction with an unpaired A_5.

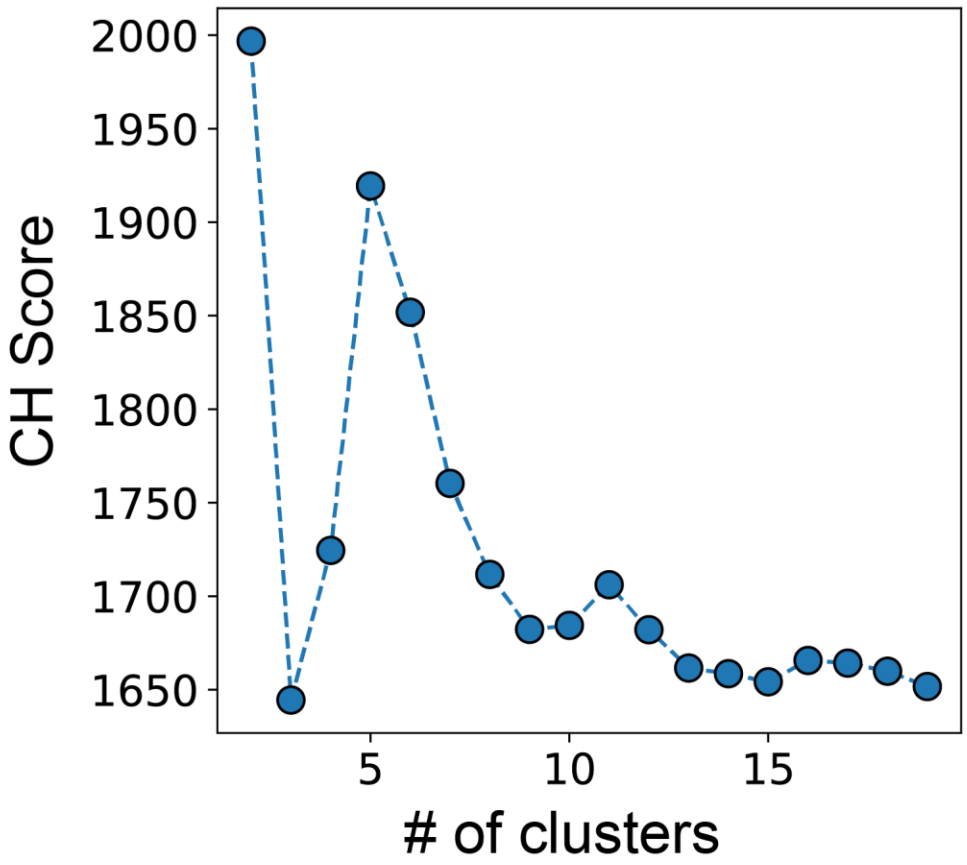
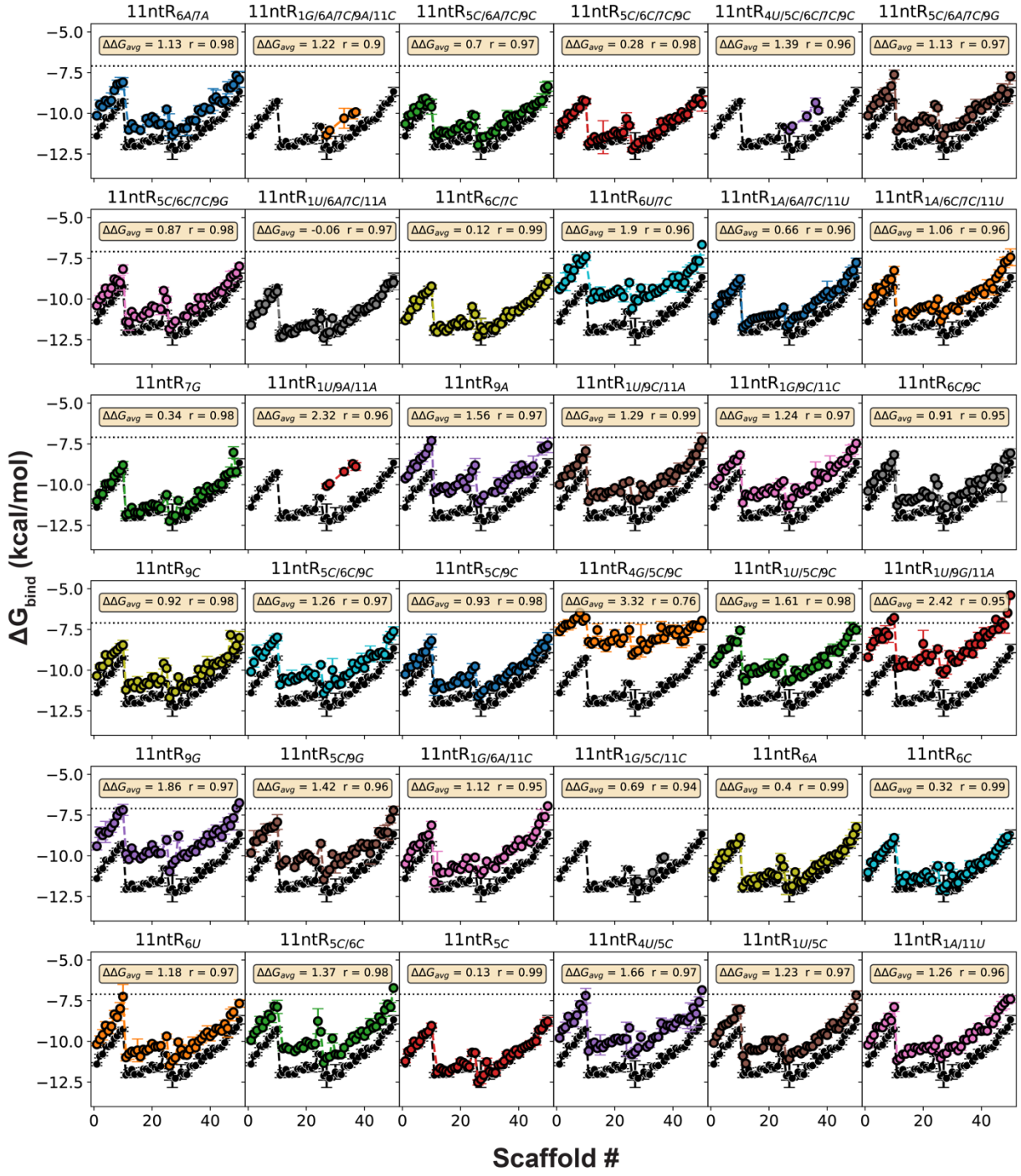


Figure S9. Determination of optimal number of clusters. Calisnky-Harabsz (CH) score, also known as variance ratio criterion, was used determine the number of clusters that best describe the variability revealed by hierarchical clustering of the TLRs across five common scaffolds and two TL sequences. The CH score takes into account the between-clusters dispersion and inter-cluster dispersion and is used as a heuristic for guiding the choice of number of clusters. The number of clusters that produce the highest score is recommended. In our analysis we discussed the clustering in terms of two major classes (A and B) and five subgroups (1-5); see main text.


11ntR6A/7A
ΔΔGavg = 1.13 r = 0.98
11ntR1G/6A/7C/9A/11C
ΔΔGavg = 1.22 r = 0.9
11ntR5C/6A/7C/9C
ΔΔGavg = 0.7 r = 0.97
11ntR5C/6C/7C/9C
ΔΔGavg = 0.28 r = 0.98
11ntR4U/5C/6C/7C/9C
ΔΔGavg = 1.39 r = 0.96
11ntR5C/6A/7C/9G
ΔΔGavg = 1.13 r = 0.97
11ntR5C/6C/7C/9G
ΔΔGavg = 0.87 r = 0.98
11ntR1U/6A/7C/11A
ΔΔGavg = -0.06 r = 0.97
11ntR6C/7C
ΔΔGavg = 0.12 r = 0.99
11ntR6U/7C
ΔΔGavg = 1.9 r = 0.96
11ntR1A/6A/7C/11U
ΔΔGavg = 0.66 r = 0.96
11ntR1A/6C/7C/11U
ΔΔGavg = 1.06 r = 0.96
11ntR7G
ΔΔGavg = 0.34 r = 0.98
11ntR1U/9A/11A
ΔΔGavg = 2.32 r = 0.96
11ntR9A
ΔΔGavg = 1.56 r = 0.97
11ntR1U/9C/11A
ΔΔGavg = 1.29 r = 0.99
11ntR1G/9C/11C
ΔΔGavg = 1.24 r = 0.97
11ntR6C/9C
ΔΔGavg = 0.91 r = 0.95
11ntR9C
ΔΔGavg = 0.92 r = 0.98
11ntR5C/6C/9C
ΔΔGavg = 1.26 r = 0.97
11ntR5C/9C
ΔΔGavg = 0.93 r = 0.98
11ntR4G/5C/9C
ΔΔGavg = 3.32 r = 0.76
11ntR1U/5C/9C
ΔΔGavg = 1.61 r = 0.98
11ntR1U/9G/11A
ΔΔGavg = 2.42 r = 0.95
11ntR9G
ΔΔGavg = 1.86 r = 0.97
11ntR5C/9G
ΔΔGavg = 1.42 r = 0.96
11ntR1G/6A/11C
ΔΔGavg = 1.12 r = 0.95
11ntR1G/5C/11C
ΔΔGavg = 0.69 r = 0.94
11ntR6A
ΔΔGavg = 0.4 r = 0.99
11ntR6C
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11ntR6U
ΔΔGavg = 1.18 r = 0.97
11ntR5C/6C
ΔΔGavg = 1.37 r = 0.98
11ntR5C
ΔΔGavg = 0.13 r = 0.99
11ntR4U/5C
ΔΔGavg = 1.66 r = 0.97
11ntR1U/5C
ΔΔGavg = 1.23 r = 0.97
11ntR1A/11U
ΔΔGavg = 1.26 r = 0.96
−5.0
−7.5
−10.0
−12.5
0
20
40
ΔGbind (kcal/mol)
Scaffold #

Figure S10. Thermodynamic fingerprints of GAAA/11ntR variants observed in sequences on natural RNAs. The name of TLR is written above each plot. Dashed grey line indicates threshold of –7.1 kcal/mol. Correlation coefficients and average difference in stability relative to GAAA/11ntR_{wt} are shown. Data was collected in the presence 30 mM $MgCl_2$.

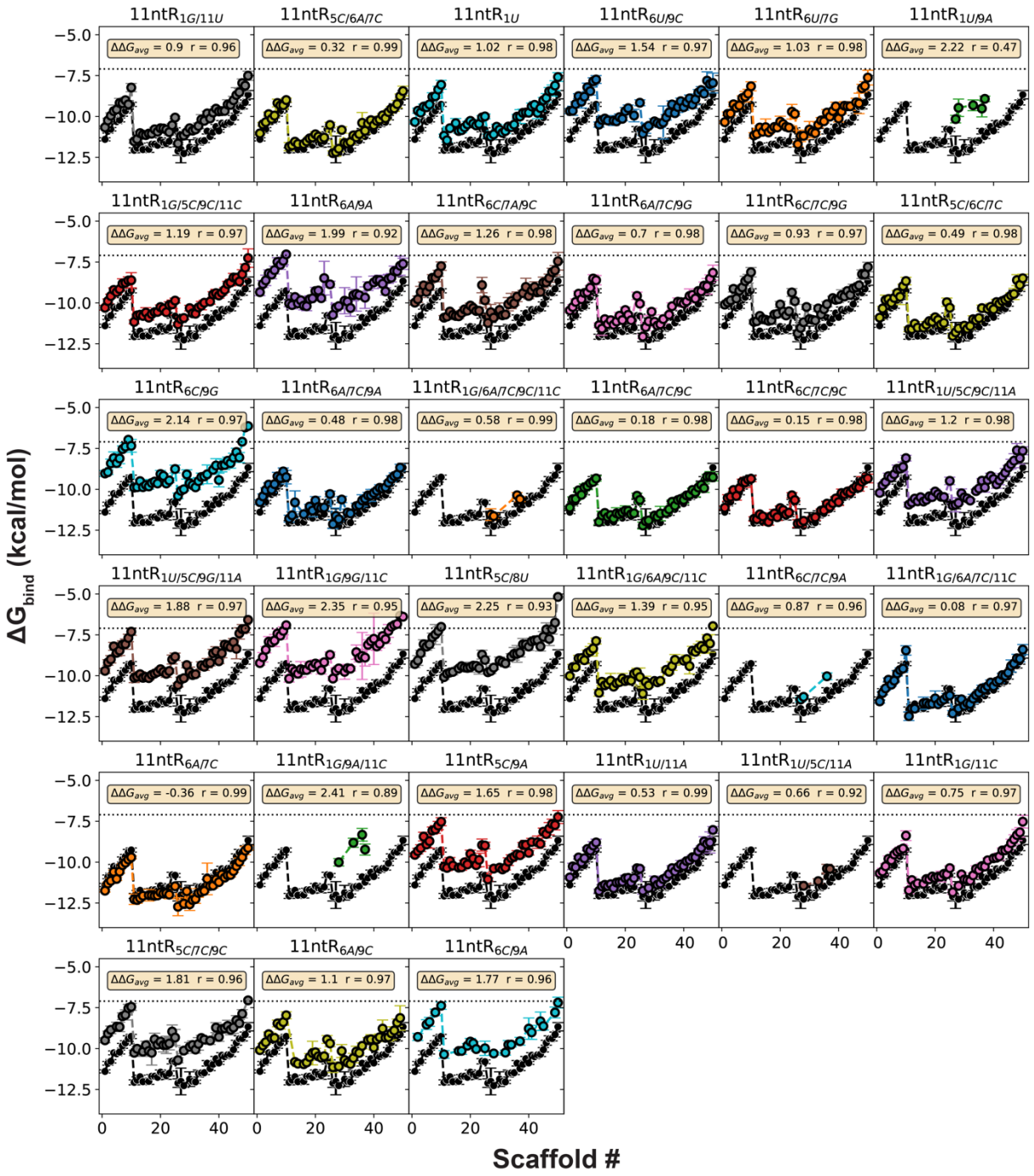

Figure S10 (continued)

Table S1. Frequency of 11ntR TLR variants found in publications and databases of structured RNAs. The location of the TL/TLR is given using standard notation where L stands for loop and P stands for paired region. Three different locations were searched for 11ntR in group I introns. The sequences were obtained from online databases of group I introns (9), group II introns (10), and RNase P (11). Sequences of c-di-GMP riboswitches were obtained from (12).

				Group I			Group II	RNAse P	c-di-GMP RS	
5'	3'	Type	Mutation	L5b-P6	L9-P5	L2-P8	ζ-ζ'	L12-P10.1	L2-P3	Total
CCUAAG	UAUGG	11ntR	WT	75	20	2	30	20	7	154
CCUAAA	CAUGG	11ntR	6A/7C	19	37	0	19	0	5	80
UCUAAG	UAUGA	11ntR	1U/11A	13	0	0	8	3	43	67
GCUAAG	UAUGC	11ntR	1G/11C	8	28	0	0	25	4	65
CCUAAC	UAUGG	11ntR	6C	11	0	0	31	0	0	42
CCUACG	UACGG	11ntR	5C/9C	34	2	0	2	0	0	38
CCUAAG	UACGG	11ntR	9C	22	2	0	4	0	4	32
CCUACG	UAUGG	11ntR	5C	21	1	0	2	8	0	32
GCUAAG	UACGC	11ntR	1G/9C/11C	1	14	0	0	0	9	24
GCUAAA	CAUGC	11ntR	1G/6A/7C/11C	11	0	0	0	4	4	19
UCUAAG	UAAGA	11ntR	1U/9A/11A	0	0	0	1	0	16	17
UCUAAG	UACGA	11ntR	1U/9C/11A	14	0	0	0	0	2	16
CCUAAA	CAAGG	11ntR	6A/7C/9A	2	7	1	2	0	2	14
GCUAAG	UAUGU	11ntR	1G/11U	0	1	0	0	12	1	14
CCUAAA	UAUGG	11ntR	6A	0	7	0	0	1	6	14
CCUAAA	CACGG	11ntR	6A/7C/9C	6	0	4	1	0	2	13
ACUAAG	UAUGU	11ntR	1A/11U	0	1	0	0	4	6	11
UCUAAA	CAUGA	11ntR	1U/6A/7C/11A	2	3	0	4	0	2	11
CCUACC	CACGG	11ntR	5C/6C/7C/9C	10	0	0	0	0	0	10
CCUACC	CAUGG	11ntR	5C/6C/7C	9	0	0	0	0	0	9
GCUAAG	UAGGC	11ntR	1G/9G/11C	6	1	0	0	2	0	9
CCUAAC	CACGG	11ntR	6C/7C/9C	5	0	0	1	0	1	7
CCUAAG	UAGGG	11ntR	9G	4	0	0	2	0	1	7
CCUACA	CACGG	11ntR	5C/6A/7C/9C	5	0	0	1	0	0	6
UCUAAG	UAUGG	11ntR	1U	4	0	0	0	0	1	5
CCUACG	UAAGG	11ntR	5C/9A	2	0	0	2	1	0	5

UCUAAG	UAGGA	11ntR	1U/9G/11A	1	0	0	1	0	3	5
GCUAAA	UAUGC	11ntR	1G/6A/11C	0	2	0	0	0	3	5
CCUACC	UAUGG	11ntR	5C/6C	3	0	0	2	0	0	5
CCUAAC	UACGG	11ntR	6C/9C	0	0	0	4	0	0	4
CCUAAC	CAUGG	11ntR	6C/7C	4	0	0	0	0	0	4
CCUAAA	UACGG	11ntR	6A/9C	1	1	0	1	0	1	4
CCUACG	CACGG	11ntR	5C/7C/9C	4	0	0	0	0	0	4
CCUACG	UAGGG	11ntR	5C/9G	1	0	0	2	0	1	4
CCUAAG	UAAGG	11ntR	9A	0	0	0	1	1	1	3
CCUAAA	AAUGG	11ntR	6A/7A	1	0	0	2	0	0	3
CCUAAC	UAAGG	11ntR	6C/9A	0	0	0	3	0	0	3
GCUACG	UAUGC	11ntR	1G/5C/11C	0	1	0	0	2	0	3
CCUACA	CAUGG	11ntR	5C/6A/7C	1	0	0	0	2	0	3
CCUAAU	CAUGG	11ntR	6U/7C	0	0	0	3	0	0	3
CCUAAC	CAAGG	11ntR	6C/7C/9A	0	2	0	0	0	0	2
UCUACG	UAUGA	11ntR	1U/5C/11A	0	0	0	0	0	2	2
GCUAAA	CACGC	11ntR	1G/6A/7C/9C/11C	0	1	0	0	0	1	2
CCUACA	CAGGG	11ntR	5C/6A/7C/9G	2	0	0	0	0	0	2
CCUAAU	GAUGG	11ntR	6U/7G	2	0	0	0	0	0	2
CCUAAU	UAUGG	11ntR	6U	0	1	0	1	0	0	2
CCUAAC	UAGGG	11ntR	6C/9G	1	0	0	1	0	0	2
CCUAAC	CAGGG	11ntR	6C/7C/9G	1	0	0	1	0	0	2
ACUAAA	CAUGU	11ntR	1A/6A/7C/11U	0	0	0	0	0	1	1
UCUACG	UAUGG	11ntR	1U/5C	1	0	0	0	0	0	1
GCUACG	UACGC	11ntR	1G/5C/9C/11C	0	1	0	0	0	0	1
CCUACG	UUUGG	11ntR	5C/8U	0	1	0	0	0	0	1
CCUAAG	GAUGG	11ntR	7G	1	0	0	0	0	0	1
UCUACG	UACGG	11ntR	1U/5C/9C	1	0	0	0	0	0	1
UCUACG	UACGA	11ntR	1U/5C/9C/11A	1	0	0	0	0	0	1
GCUAAG	UAAGC	11ntR	1G/9A/11C	0	0	0	0	0	1	1
CCUAAC	AACGG	11ntR	6C/7A/9C	1	0	0	0	0	0	1
CCUUCG	UAUGG	11ntR	4U/5C	1	0	0	0	0	0	1
CCUAAU	UACGG	11ntR	6U/9C	1	0	0	0	0	0	1
UCUACG	UAGGA	11ntR	1U/5C/9G/11A	1	0	0	0	0	0	1
ACUAAC	CAUGU	11ntR	1A/6C/7C/11U	0	1	0	0	0	0	1
CCUACC	UACGG	11ntR	5C/6C/9C	1	0	0	0	0	0	1
GCUAAA	CAAGC	11ntR	1G/6A/7C/9A/11C	0	0	0	0	0	1	1
CCUGCG	UACGG	11ntR	4G/5C/9C	1	0	0	0	0	0	1

GCUAAA	UACGC	11ntR	1G/6A/9C/11C	0	1	0	0	0	0	1
UCUAAG	UAAGG	11ntR	1U/9A	0	0	0	0	0	1	1
CCUAAA	UAAGG	11ntR	6A/9A	1	0	0	0	0	0	1
CCUAAA	CAGGG	11ntR	6A/7C/9G	0	0	0	0	0	1	1
CCUUCC	CACGG	11ntR	4U/5C/6C/7C/9C	1	0	0	0	0	0	1
CCUACC	CAGGG	11ntR	5C/6C/7C/9G	1	0	0	0	0	0	1

Table S2. Frequency of 12ntR TLR variants found in publications and databases of structured RNAs. The location of the TL/TLR is given using standard notation where L stands for loop and P stands for paired region. The sequences were obtained from online databases of group I introns (9), group II introns (10), and RNase P (11). Sequences of c-di-GMP riboswitches were obtained from (12).

				Group I			Group II	RNase P	c-di-GMP RS	
5'	3'	Type	Mutation	L5b-P6	L9-P5	L2-P8	ζ-ζ'	L12-P10.1	L2-P3	Total
CCCUAAC	GAGGG	12ntR	WT	3	1	60	0	0	0	64
UUCUAAC	GAGAA	12ntR	1U/2U/11A/12A	0	0	39	0	0	0	39
UUCUAAC	GAGGA	12ntR	1U/2U/12A	0	0	12	0	0	0	12
UCCUAAC	GAGGA	12ntR	1U/12A	0	0	4	0	0	0	4
CCUAAAC	GUAGG	12ntR	3U/4A/9U/10A	0	0	0	0	0	4	4
CCCUAAG	UAGGG	12ntR	7G/8U	2	0	0	0	0	0	2
CCCGACC	GAGGG	12ntR	4G/6C	2	0	0	0	0	0	2
CCCUACC	AAGGG	12ntR	6C/8A	0	0	0	0	0	2	2
CCUUAAC	GAAGG	12ntR	3U/10A	0	1	0	0	0	0	1
CCCUAAC	GAAGG	12ntR	10A	0	0	1	0	0	0	1
CCGUAAC	GACGG	12ntR	3G/10C	1	0	0	0	0	0	1
CCCUGAC	GAGGG	12ntR	5G	0	0	1	0	0	0	1
CCUAAAC	AUAGG	12ntR	3U/4A/8A/9U/10A	0	0	0	0	0	1	1

Table S3. Classification of TLRs based on hierarchical clustering. $\Delta G_{GAAA,avg}$ and $\Delta G_{GUAA,avg}$ are mean values across five scaffolds shown in Figure 5A binding to flow pieces with GAAA or GUAA TLs respectively. GAAA specificity is defined as $\Delta G_{GUAA,avg} - \Delta G_{GAAA,avg}$; greater positive numbers indicate higher specificity for GAAA TL relative to GUAA. Classes and subgroups are as defined in main text and Figure 5.

5'	3'	Type	Found in natural RNA?	Class	Subgroup	$\Delta G_{GAAA, avg}$ (kcal/mol)	$\Delta G_{GUAA, avg}$ (kcal/mol)	GAAA specificity (kcal/mol)
CCUUCC	AAUGG	11ntR	no	A	1	-10.59	-7.72	2.87
GCUAAA	CAAGC	11ntR	yes	A	1	-10.53	-7.56	2.97
CCUACA	CACGG	11ntR	yes	A	1	-10.85	-7.96	2.89
CCUACC	CACGG	11ntR	yes	A	1	-11.30	-8.36	2.94
CCUUCC	CACGG	11ntR	yes	A	1	-10.24	-7.79	2.45
CCUACA	CAGGG	11ntR	yes	A	1	-10.58	-7.98	2.59
CCUACC	CAGGG	11ntR	yes	A	1	-10.75	-7.94	2.82
UCUAAA	CAUGA	11ntR	yes	A	1	-11.50	-8.10	3.41
GCUACA	CAUGC	11ntR	no	A	1	-10.80	-7.59	3.21
CCUAAC	CAUGG	11ntR	yes	A	1	-11.39	-8.05	3.34
ACUAAA	CAUGU	11ntR	yes	A	1	-10.73	-7.71	3.02
ACUAAC	CAUGU	11ntR	yes	A	1	-10.29	-7.52	2.77
CCUAAG	GAUGG	11ntR	yes	A	1	-11.24	-7.92	3.31
CCUGAAC	GAUGG	C7.2	no	A	1	-11.10	-8.15	2.95
UCUAAG	GAUGG	11ntR	no	A	1	-10.20	-7.29	2.92
CCUAAG	UAAGG	11ntR	yes	A	1	-10.16	-7.85	2.31
UCUAAG	UACGA	11ntR	yes	A	1	-10.31	-7.32	2.99
GCUAAG	UACGC	11ntR	yes	A	1	-10.32	-7.26	3.06
CCUAAC	UACGG	11ntR	yes	A	1	-10.69	-7.54	3.15
CCUAAG	UACGG	11ntR	yes	A	1	-10.72	-7.54	3.18
CCUACC	UACGG	11ntR	yes	A	1	-10.39	-7.67	2.73
CCUACG	UACGG	11ntR	yes	A	1	-10.71	-7.76	2.96
CCUACU	UACGG	11ntR	no	A	1	-10.13	-7.68	2.46
GCUAAG	UACGG	11ntR	no	A	1	-9.91	-7.48	2.43
UCUAAG	UACGG	11ntR	no	A	1	-10.00	-7.22	2.78
UCUACG	UACGG	11ntR	yes	A	1	-10.07	-7.31	2.76
CCUAAG	UAGGG	11ntR	yes	A	1	-9.84	-7.55	2.30
CCUACG	UAGGG	11ntR	yes	A	1	-10.28	-7.82	2.46
CCUAAC	UAUGA	11ntR	no	A	1	-9.82	-7.14	2.68
CCUAAG	UAUGA	11ntR	no	A	1	-10.04	-7.31	2.73
CCUACG	UAUGA	11ntR	no	A	1	-10.13	-7.16	2.97
GCUAAG	UAUGA	11ntR	no	A	1	-9.57	-7.10	2.47
GCUAAA	UAUGC	11ntR	yes	A	1	-10.33	-7.57	2.76
GCUACG	UAUGC	11ntR	yes	A	1	-10.90	-7.41	3.49
CCUAAA	UAUGG	11ntR	yes	A	1	-11.24	-8.27	2.97
CCUAAC	UAUGG	11ntR	yes	A	1	-11.26	-7.60	3.66
CCUAAG	UAUGG	11ntR	yes	A	1	-11.58	-8.12	3.46
CCUAAU	UAUGG	11ntR	yes	A	1	-10.50	-7.66	2.84
CCUACC	UAUGG	11ntR	yes	A	1	-10.39	-7.48	2.90
CCUACG	UAUGG	11ntR	yes	A	1	-11.51	-8.01	3.51
CCUGCG	UAUGG	11ntR	no	A	1	-10.44	-7.81	2.63

CCUGUC	UAUGG	11ntR	no	A	1	-10.67	-8.11	2.57
GCUAAA	UAUGG	11ntR	no	A	1	-10.28	-7.69	2.59
GCUAAC	UAUGG	11ntR	no	A	1	-10.67	-7.66	3.00
GCUAAG	UAUGG	11ntR	no	A	1	-10.77	-7.69	3.08
GCUACG	UAUGG	11ntR	no	A	1	-10.32	-7.47	2.85
UCUAAC	UAUGG	11ntR	no	A	1	-10.34	-7.15	3.19
UCUACG	UAUGG	11ntR	yes	A	1	-10.37	-7.37	3.00
ACUAAG	UAUGU	11ntR	yes	A	1	-10.22	-7.35	2.87
GCUAAG	UAUGU	11ntR	yes	A	1	-10.58	-7.43	3.15
CCUACU	UAUGG	11ntR	no	A	1	-10.42	-7.57	2.85
CCUACA	CAUGG	11ntR	yes	A	1	-11.31	-8.13	3.18
UCUAAG	UAUGG	11ntR	yes	A	1	-10.59	-7.24	3.35
CCUACC	CAAGG	11ntR	no	A	1	-10.59	-7.98	2.62
CCUUCC	CAUGG	11ntR	no	A	1	-10.48	-7.89	2.59
CCUGUAC	GAUGG	C7.2	no	A	1	-11.87	-8.19	3.68
GCUACG	UACGC	11ntR	yes	A	1	-10.38	-7.24	3.14
CCUACC	UAGGG	11ntR	no	A	1	-10.25	-7.73	2.52
CCUAAAC	UAUGG	12ntR	no	A	1	-10.15	-7.67	2.47
CCUAAA	CAGGG	11ntR	yes	A	1	-10.88	-7.79	3.08
CCUAAC	CAGGG	11ntR	yes	A	1	-10.61	-7.86	2.75
CCUACC	CAUGG	11ntR	yes	A	1	-11.05	-7.86	3.19
CCUAAA	CAAGG	11ntR	yes	A	1	-11.19	-8.04	3.16
GCUAAA	CACGC	11ntR	yes	A	1	-11.08	-7.96	3.13
CCUAAA	CACGG	11ntR	yes	A	1	-11.38	-8.30	3.08
CCUAAC	CACGG	11ntR	yes	A	1	-11.44	-8.41	3.04
CCUGGAC	GAUGG	C7.2	no	A	1	-11.62	-8.21	3.42
UCUACG	UACGA	11ntR	yes	A	1	-10.28	-7.25	3.04
UCUACG	UAGGA	11ntR	yes	A	1	-9.74	-7.19	2.56
GCUACG	UAGGC	11ntR	no	A	1	-9.66	-7.17	2.50
UCUAAA	UAUGG	11ntR	no	A	1	-10.15	-7.42	2.74
CCUUUAC	GAUGG	C7.2	no	A	1	-9.87	-7.47	2.40
CCUAAC	CAAGG	11ntR	yes	A	1	-10.68	-7.78	2.89
GCUAAA	CAGGC	11ntR	no	A	1	-10.44	-7.24	3.21
GCUAAA	CAUGC	11ntR	yes	A	1	-11.39	-7.93	3.46
CCUAAA	CAUGG	11ntR	yes	A	1	-11.77	-8.36	3.41
CCUAAA	GAUGG	11ntR	no	A	1	-10.42	-7.91	2.52
CCUGCAC	GAUGG	C7.2	no	A	1	-11.54	-8.30	3.24
UCUAAG	UAUGA	11ntR	yes	A	1	-10.95	-7.55	3.40
UCUACG	UAUGA	11ntR	yes	A	1	-11.01	-7.36	3.65
GCUAAG	UAUGC	11ntR	yes	A	1	-10.79	-7.41	3.39
CCUAAA	UACGG	11ntR	yes	A	1	-10.59	-8.07	2.52
CCUGCC	AAAGG	11ntR	no	A	2	-10.03	-8.46	1.56
CCUACG	AACGG	11ntR	no	A	2	-9.55	-8.25	1.30
CCUGCC	AACGG	11ntR	no	A	2	-11.29	-9.04	2.25
CCUAAA	AAUGG	11ntR	yes	A	2	-10.53	-8.10	2.43
CCUAAC	AAUGG	11ntR	no	A	2	-10.49	-8.22	2.27
CCUACC	AAUGG	11ntR	no	A	2	-10.17	-7.80	2.37
CCUACG	AAUGG	11ntR	no	A	2	-9.16	-7.86	1.30
CCUACU	AAUGG	11ntR	no	A	2	-9.64	-7.98	1.66
CCUGUG	AAUGG	11ntR	no	A	2	-9.56	-7.92	1.64
CCUUAG	AAUGG	11ntR	no	A	2	-9.39	-7.97	1.41
UCUAAG	AAUGG	11ntR	no	A	2	-8.35	-7.18	1.18
CCUGCC	ACUGG	11ntR	no	A	2	-9.06	-7.47	1.59
CCUAGA	CACGG	11ntR	no	A	2	-9.45	-8.10	1.35
CCUAGC	CACGG	11ntR	no	A	2	-9.09	-7.71	1.38
CCUCCC	CACGG	11ntR	no	A	2	-9.78	-8.34	1.44
CCUGAA	CACGG	11ntR	no	A	2	-9.06	-7.69	1.38

CCUGAC	CACGG	11ntR	no	A	2	-9.19	-7.80	1.39
CCUGCC	CACGG	11ntR	no	A	2	-10.12	-8.14	1.98
CCUUAA	CACGG	11ntR	no	A	2	-9.68	-8.33	1.35
CCUUAC	CACGG	11ntR	no	A	2	-9.76	-7.99	1.77
GCUCAA	CAUGC	11ntR	no	A	2	-8.82	-7.45	1.36
GCUUAA	CAUGC	11ntR	no	A	2	-9.56	-7.43	2.14
UCUAAA	CAUGC	11ntR	no	A	2	-9.45	-7.10	2.35
CCUAAU	CAUGG	11ntR	yes	A	2	-9.63	-7.76	1.88
CCUCAA	CAUGG	11ntR	no	A	2	-9.47	-7.81	1.66
CCUCCC	CAUGG	11ntR	no	A	2	-9.87	-7.94	1.93
CCUGCC	CAUGG	11ntR	no	A	2	-10.05	-7.80	2.25
CCUGUAC	CAUGG	C7.2	no	A	2	-10.47	-8.17	2.30
CCUGUG	CAUGG	11ntR	no	A	2	-9.10	-7.73	1.37
CCUUAA	CAUGG	11ntR	no	A	2	-10.37	-7.98	2.40
CCUAAG	GACGG	11ntR	no	A	2	-11.30	-8.78	2.51
CCUACG	GACGG	11ntR	no	A	2	-10.02	-7.79	2.24
CCUUAAC	GAGGC	12ntR	no	A	2	-8.59	-7.26	1.33
CCUAAG	GAGGG	11ntR	no	A	2	-9.85	-7.77	2.08
CCUAAG	GAUGA	11ntR	no	A	2	-9.40	-7.38	2.02
CCUAAG	GAUGC	11ntR	no	A	2	-8.40	-7.11	1.29
ACUAAG	GAUGG	11ntR	no	A	2	-8.92	-7.10	1.82
CCCUAAG	GAUGG	12ntR	no	A	2	-9.12	-7.94	1.18
CCUACAC	GAUGG	C7.2	no	A	2	-9.70	-7.95	1.74
CCUACG	GAUGG	11ntR	no	A	2	-9.36	-7.73	1.63
CCUCCAC	GAUGG	C7.2	no	A	2	-9.30	-7.79	1.51
CCUCUAC	GAUGG	C7.2	no	A	2	-9.54	-7.83	1.71
CCUGAG	GAUGG	11ntR	no	A	2	-9.16	-7.42	1.73
CCUGCCC	GAUGG	C7.2	no	A	2	-10.15	-8.20	1.95
CCUGCGC	GAUGG	C7.2	no	A	2	-9.66	-8.01	1.65
CCUGCUC	GAUGG	C7.2	no	A	2	-9.62	-8.18	1.44
CCUGUAA	GAUGG	C7.2	no	A	2	-9.61	-8.28	1.33
CCUGUAG	GAUGG	C7.2	no	A	2	-9.75	-7.81	1.94
CCUGUAU	GAUGG	C7.2	no	A	2	-9.54	-8.15	1.39
CCUGUCC	GAUGG	C7.2	no	A	2	-9.65	-7.93	1.71
CCUGUG	GAUGG	11ntR	no	A	2	-10.05	-7.93	2.12
CCUGUUC	GAUGG	C7.2	no	A	2	-9.42	-7.89	1.53
CCUUCAC	GAUGG	C7.2	no	A	2	-9.86	-8.10	1.76
CUUAAG	GAUGG	11ntR	no	A	2	-8.32	-7.14	1.18
GCUAAG	GAUGG	11ntR	no	A	2	-10.13	-7.79	2.35
CCUAAG	GAUGU	11ntR	no	A	2	-8.30	-7.10	1.20
CCUGCAC	GCUGG	C7.2	no	A	2	-8.45	-7.34	1.11
CCUAAG	UAAGA	11ntR	no	A	2	-8.55	-7.14	1.41
UCUAAG	UAAGA	11ntR	yes	A	2	-9.37	-7.22	2.16
ACUAAC	UAAGG	11ntR	no	A	2	-8.23	-7.10	1.13
CCUAAAG	UAAGG	12ntR	no	A	2	-9.41	-7.90	1.50
GCUAAG	UAAGG	11ntR	no	A	2	-9.47	-7.69	1.78
CCUAAG	UACGA	11ntR	no	A	2	-9.19	-7.16	2.02
CCUAAG	UACGC	11ntR	no	A	2	-8.87	-7.10	1.77
ACUAAG	UACGG	11ntR	no	A	2	-8.53	-7.10	1.43
CCUAUG	UACGG	11ntR	no	A	2	-8.95	-7.45	1.50
UCUAAG	UAGGA	11ntR	yes	A	2	-9.35	-7.10	2.25
ACCUAAC	UAGGG	12ntR	no	A	2	-8.51	-7.28	1.23
GCUAAG	UAGGG	11ntR	no	A	2	-9.04	-7.59	1.45
UCUAAG	UAGGG	11ntR	no	A	2	-9.22	-7.22	2.01
CUUAAG	UAUAG	11ntR	no	A	2	-8.42	-7.16	1.26
UCUAAG	UAUCG	11ntR	no	A	2	-9.52	-7.21	2.30
ACUAAG	UAUGA	11ntR	no	A	2	-9.43	-7.26	2.17

CCUAAA	UAUGA	11ntR	no	A	2	-9.63	-7.39	2.24
CCUAAU	UAUGA	11ntR	no	A	2	-8.92	-7.43	1.49
UCUAUG	UAUGA	11ntR	no	A	2	-8.30	-7.14	1.16
UCUUAG	UAUGA	11ntR	no	A	2	-8.62	-7.31	1.31
ACUAAG	UAUGC	11ntR	no	A	2	-9.23	-7.10	2.13
CCUAAA	UAUGC	11ntR	no	A	2	-8.71	-7.20	1.51
CCUAAC	UAUGC	11ntR	no	A	2	-9.04	-7.10	1.94
CCUAAG	UAUGC	11ntR	no	A	2	-9.16	-7.11	2.06
CCUACG	UAUGC	11ntR	no	A	2	-9.32	-7.19	2.13
GCUGAG	UAUGC	11ntR	no	A	2	-8.68	-7.13	1.55
GCUUAG	UAUGC	11ntR	no	A	2	-8.38	-7.16	1.22
UCUAAG	UAUGC	11ntR	no	A	2	-8.77	-7.10	1.67
ACUAAA	UAUGG	11ntR	no	A	2	-9.01	-7.21	1.79
ACUAAC	UAUGG	11ntR	no	A	2	-9.47	-7.10	2.37
ACUAAG	UAUGG	11ntR	no	A	2	-9.40	-7.14	2.26
ACUAAU	UAUGG	11ntR	no	A	2	-8.54	-7.10	1.43
ACUACG	UAUGG	11ntR	no	A	2	-8.94	-7.14	1.80
ACUAGAG	UAUGG	C7.2	no	A	2	-8.41	-7.10	1.31
CAUAAC	UAUGG	11ntR	no	A	2	-8.55	-7.10	1.45
CAUAAG	UAUGG	11ntR	no	A	2	-8.28	-7.13	1.15
CCCUAAC	UAUGG	12ntR	no	A	2	-9.06	-7.55	1.51
CCUAGG	UAUGG	11ntR	no	A	2	-9.13	-7.63	1.50
CCUAUU	UAUGG	11ntR	no	A	2	-9.21	-7.75	1.45
CCUCAG	UAUGG	11ntR	no	A	2	-8.98	-7.76	1.22
CCUGAA	UAUGG	11ntR	no	A	2	-9.52	-7.75	1.78
CCUGUAC	UAUGG	C7.2	no	A	2	-9.88	-7.65	2.23
CCUGUU	UAUGG	11ntR	no	A	2	-10.34	-7.98	2.36
CCUUAC	UAUGG	11ntR	no	A	2	-9.38	-7.63	1.75
CCUUAG	UAUGG	11ntR	no	A	2	-9.46	-7.63	1.83
CCUUCG	UAUGG	11ntR	yes	A	2	-9.82	-7.58	2.24
CCUUUG	UAUGG	11ntR	no	A	2	-8.48	-7.36	1.12
CUUAAC	UAUGG	11ntR	no	A	2	-9.30	-7.10	2.20
CUUAAG	UAUGG	11ntR	no	A	2	-8.83	-7.29	1.55
CUUAAU	UAUGG	11ntR	no	A	2	-8.51	-7.21	1.30
CUUACG	UAUGG	11ntR	no	A	2	-8.95	-7.46	1.49
GCUAAU	UAUGG	11ntR	no	A	2	-9.91	-7.75	2.16
GCUGAG	UAUGG	11ntR	no	A	2	-8.95	-7.59	1.36
GUUAAG	UAUGG	11ntR	no	A	2	-8.48	-7.11	1.37
UCUGAG	UAUGG	11ntR	no	A	2	-8.82	-7.10	1.72
UCUUAG	UAUGG	11ntR	no	A	2	-8.50	-7.10	1.40
UUUAAG	UAUGG	11ntR	no	A	2	-8.45	-7.10	1.35
CCUAAC	UAUGU	11ntR	no	A	2	-8.60	-7.10	1.50
CCUAAG	UAUGU	11ntR	no	A	2	-8.90	-7.10	1.80
CCUACG	UAUGU	11ntR	no	A	2	-8.71	-7.10	1.61
UCUAAG	UAUGU	11ntR	no	A	2	-9.60	-7.21	2.39
UCUAAG	UAUUG	11ntR	no	A	2	-9.41	-7.17	2.24
CCUUAG	UCUGG	11ntR	no	A	2	-8.38	-7.15	1.23
CCUCAC	CACGG	11ntR	no	A	2	-9.19	-7.78	1.42
CCUAAU	CACGG	11ntR	no	A	2	-9.93	-8.14	1.79
CCUUAC	GAUGG	11ntR	no	A	2	-9.90	-7.70	2.20
CCUCCG	UAUGG	11ntR	no	A	2	-9.87	-7.84	2.04
CCUAAU	UACGG	11ntR	yes	A	2	-10.14	-7.88	2.26
CCUAAU	GAUGG	11ntR	yes	A	2	-10.53	-8.57	1.96
ACCUAAC	CAGGG	12ntR	no	A	2	-9.33	-7.51	1.81
CCCUAAC	CAUGG	12ntR	no	A	2	-9.71	-7.70	2.01
UCUAAG	UAAGG	11ntR	yes	A	2	-9.48	-7.10	2.38
CCUAAA	AACGG	11ntR	no	A	2	-9.87	-7.89	1.98

CCUAAG	AAUGG	11ntR	no	A	2	-9.72	-7.99	1.74
CCCUAAC	CACGG	12ntR	no	A	2	-9.24	-7.91	1.32
CCUAUC	CACGG	11ntR	no	A	2	-10.03	-7.85	2.18
GCUGAA	CAUGC	11ntR	no	A	2	-8.81	-7.27	1.54
CCUAUA	CAUGG	11ntR	no	A	2	-9.80	-7.90	1.90
CCUUAAC	GAGGU	12ntR	no	A	2	-8.36	-7.18	1.18
CCUAAAG	GAUGG	12ntR	no	A	2	-10.29	-8.35	1.94
CCUACU	GAUGG	11ntR	no	A	2	-10.12	-7.86	2.26
UCUGAG	UAUGA	11ntR	no	A	2	-9.05	-7.25	1.80
CCUGAG	UAUGG	11ntR	no	A	2	-9.70	-7.84	1.87
CCUAAA	UAUGU	11ntR	no	A	2	-8.38	-7.23	1.15
CCUGAG	UGUGG	11ntR	no	A	2	-8.83	-7.43	1.40
CCUAAA	UAAGG	11ntR	yes	A	2	-10.08	-7.95	2.13
CCUAAU	AAUGG	11ntR	no	A	2	-10.47	-8.49	1.98
CCUUAA	UAUGG	11ntR	no	A	2	-9.41	-7.60	1.81
CCUAAC	AACGG	11ntR	yes	A	2	-10.22	-8.26	1.96
CCUGUAC	AAUGG	C7.2	no	A	2	-10.00	-7.93	2.08
UCUAGG	UACGA	11ntR	no	A	2	-8.38	-7.12	1.27
CCUAAC	UAGGG	11ntR	yes	A	2	-9.53	-7.48	2.05
CCUGUG	UGUGG	11ntR	no	A	2	-9.25	-7.37	1.89
CCUCAC	UAUGG	11ntR	no	A	2	-9.64	-7.88	1.76
CCUGCC	AAGGG	11ntR	no	A	2	-10.28	-8.19	2.09
CCUGGC	AAUGG	11ntR	no	A	2	-9.87	-8.01	1.87
CCUAUA	CACGG	11ntR	no	A	2	-9.64	-7.88	1.76
CCUAUC	CAUGG	11ntR	no	A	2	-9.77	-7.72	2.05
UCUAAG	CAUGG	11ntR	no	A	2	-8.43	-7.17	1.26
GCUAAG	GAAGC	11ntR	no	A	2	-8.66	-7.43	1.23
CCUUAG	GAUGG	11ntR	no	A	2	-9.68	-7.58	2.11
GCUAAG	UAGGC	11ntR	yes	A	2	-9.37	-7.13	2.24
ACUAAG	UAGGG	11ntR	no	A	2	-8.33	-7.20	1.12
CCUAAAG	UAUGG	12ntR	no	A	2	-11.13	-8.59	2.54
CCUACA	UAUGG	11ntR	no	A	2	-10.15	-8.05	2.11
CCUAUC	UAUGG	11ntR	no	A	2	-9.12	-7.57	1.54
CCUGAC	UAUGG	11ntR	no	A	2	-9.49	-7.49	2.01
CCUGAU	UAUGG	11ntR	no	A	2	-9.50	-8.00	1.51
CCUGGG	UAUGG	11ntR	no	A	2	-10.07	-7.97	2.10
CCUACG	UUUGG	11ntR	yes	A	2	-9.21	-7.64	1.56
CCUUAAC	GAUGG	12ntR	no	A	2	-9.66	-7.91	1.75
GCUAAA	UACGC	11ntR	yes	A	2	-9.95	-7.59	2.36
CCUAAA	GACGG	11ntR	no	A	2	-8.91	-7.59	1.32
CCUAAC	GAUGG	11ntR	no	A	2	-9.33	-7.90	1.42
CCUAAG	CACGG	11ntR	no	A	2	-9.71	-8.04	1.67
CCUACG	CAUGG	11ntR	no	A	2	-9.74	-7.97	1.77
CCUGAC	AAUGG	11ntR	no	A	2	-10.15	-8.56	1.59
CCUGUC	AAUGG	11ntR	no	A	2	-10.66	-8.16	2.50
GCUAAG	CAUGC	11ntR	no	A	2	-8.72	-7.29	1.42
CCUGAA	CAUGG	11ntR	no	A	2	-9.52	-7.56	1.96
CCUGUGC	GAUGG	C7.2	no	A	2	-9.40	-7.98	1.42
GCUAAG	UAAGC	11ntR	yes	A	2	-9.21	-7.24	1.98
CCUACG	UAAGG	11ntR	yes	A	2	-10.03	-7.95	2.08
UCUAUG	UACGA	11ntR	no	A	2	-8.55	-7.10	1.45
CCUACA	UACGG	11ntR	no	A	2	-10.27	-7.98	2.29
CCUUCG	UACGG	11ntR	no	A	2	-9.27	-7.67	1.60
CCUAAG	UACGU	11ntR	no	A	2	-8.50	-7.14	1.35
CCUAAA	UAGGG	11ntR	no	A	2	-9.32	-7.62	1.71
CCUACG	CACGG	11ntR	yes	A	2	-9.78	-7.97	1.81
CCUAAU	UAGGG	11ntR	no	A	2	-8.64	-7.34	1.29

CCUAAG	CAUGG	11ntR	no	A	2	-9.83	-7.79	2.04
CCCUAAC	AAGGG	12ntR	no	A	2	-9.53	-8.38	1.15
CCUGUA	UAUGG	11ntR	no	A	2	-9.90	-7.75	2.15
UCUAAU	UAUGG	11ntR	no	A	2	-9.63	-7.31	2.32
CCUACU	CAUGG	11ntR	no	A	2	-9.98	-8.01	1.97
CCUAAU	UAAGG	11ntR	no	A	2	-9.14	-7.79	1.35
CCUAUAC	GAUGG	C7.2	no	A	2	-9.61	-7.86	1.75
CCUAAC	UAAGG	11ntR	yes	A	2	-9.85	-7.75	2.11
CCCUAAC	AACGG	12ntR	no	B	3	-8.32	-7.57	0.75
CCCUAAC	AAGAG	12ntR	no	B	3	-7.51	-7.24	0.27
CCUAAG	AAUGA	11ntR	no	B	3	-7.43	-7.11	0.32
CCUAUG	AAUGG	11ntR	no	B	3	-8.73	-7.87	0.86
CCUCAG	AAUGG	11ntR	no	B	3	-8.22	-7.79	0.44
GCUAAG	AAUGG	11ntR	no	B	3	-8.28	-7.74	0.54
CCUAAG	AGUGG	11ntR	no	B	3	-8.09	-7.76	0.33
CCUGCC	AGUGG	11ntR	no	B	3	-8.10	-7.66	0.44
CCUAAG	AUUGG	11ntR	no	B	3	-8.48	-7.77	0.71
CCUGCC	AUUGG	11ntR	no	B	3	-8.79	-7.50	1.28
CCGAAA	CACGG	11ntR	no	B	3	-8.67	-8.14	0.53
CCUCAA	CACGG	11ntR	no	B	3	-8.84	-7.87	0.96
CCCUAAC	CAGCG	12ntR	no	B	3	-7.34	-7.14	0.20
CACUAAC	CAGGG	12ntR	no	B	3	-8.21	-7.28	0.93
CCGUAAC	CAGGG	12ntR	no	B	3	-7.79	-7.45	0.35
CCUACG	CAGGG	11ntR	no	B	3	-8.82	-7.81	1.02
CCUAAG	CAUGA	11ntR	no	B	3	-7.94	-7.10	0.84
CCUAAG	CAUGC	11ntR	no	B	3	-7.51	-7.19	0.32
GCUAGA	CAUGC	11ntR	no	B	3	-7.50	-7.21	0.29
CCCAAA	CAUGG	11ntR	no	B	3	-8.27	-7.59	0.68
CCUAGC	CAUGG	11ntR	no	B	3	-7.89	-7.27	0.62
CCUGAG	CAUGG	11ntR	no	B	3	-8.73	-7.71	1.02
GCUAAG	CAUGG	11ntR	no	B	3	-8.34	-7.35	0.99
CCUAAAG	GAAGG	12ntR	no	B	3	-9.27	-8.56	0.71
CCUGCAC	GAAGG	C7.2	no	B	3	-8.96	-8.36	0.59
CCCUAUC	GACGG	12ntR	no	B	3	-8.70	-7.78	0.93
GCCUAAC	GACGG	12ntR	no	B	3	-8.69	-8.49	0.20
CCCUACC	GAGAG	12ntR	no	B	3	-7.49	-7.11	0.38
CCUUAAC	GAGGA	12ntR	no	B	3	-7.72	-7.17	0.54
CCAUAAC	GAGGC	12ntR	no	B	3	-7.42	-7.13	0.29
CCGUAAC	GAGGC	12ntR	no	B	3	-7.57	-7.26	0.31
CCGUAAA	GAGGG	12ntR	no	B	3	-7.89	-7.57	0.32
CCGUAAC	GAGGU	12ntR	no	B	3	-7.71	-7.25	0.46
CUCUAAC	GAGUG	12ntR	no	B	3	-7.80	-7.46	0.34
ACCUAAC	GAUGG	12ntR	no	B	3	-9.07	-8.02	1.05
CCCGAAC	GAUGG	12ntR	no	B	3	-8.34	-8.27	0.07
CCUAUG	GAUGG	11ntR	no	B	3	-8.21	-7.79	0.42
GCCUAAC	GAUGG	12ntR	no	B	3	-9.04	-8.23	0.81
UCCUAAC	GAUGG	12ntR	no	B	3	-8.77	-8.55	0.22
CCCUAAC	GCAGG	12ntR	no	B	3	-8.31	-7.97	0.34
CCGUAAC	GCGGG	12ntR	no	B	3	-8.09	-7.68	0.41
CCCUAAC	GGGGC	12ntR	no	B	3	-7.74	-7.34	0.40
CCUAAG	UAAGC	11ntR	no	B	3	-7.91	-7.10	0.81
ACUAAG	UAAGG	11ntR	no	B	3	-8.08	-7.10	0.98
CCUGUG	UAAGG	11ntR	no	B	3	-8.65	-7.59	1.06
UCUCAG	UACGA	11ntR	no	B	3	-7.74	-7.45	0.29
UCUUAG	UACGA	11ntR	no	B	3	-7.74	-7.22	0.51
CAUAAG	UACGG	11ntR	no	B	3	-8.02	-7.12	0.89
CCCUAAC	UACGG	12ntR	no	B	3	-8.12	-7.54	0.58

CCUCCG	UACGG	11ntR	no	B	3	-8.72	-7.87	0.85
CCUGUG	UACGG	11ntR	no	B	3	-8.09	-7.25	0.84
CCUUAG	UACGG	11ntR	no	B	3	-8.19	-7.52	0.67
CGUAAG	UACGG	11ntR	no	B	3	-8.07	-7.19	0.88
CUUAAG	UACGG	11ntR	no	B	3	-8.09	-7.10	0.99
CCUAAG	UACUG	11ntR	no	B	3	-7.64	-7.14	0.49
CAUAAG	UAGGG	11ntR	no	B	3	-8.04	-7.10	0.94
CCUAUG	UAGGG	11ntR	no	B	3	-8.02	-7.43	0.58
CCUGUG	UAGGG	11ntR	no	B	3	-8.30	-7.38	0.92
CCUAAG	UAGGU	11ntR	no	B	3	-8.05	-7.17	0.88
CCUAAC	UAUAG	11ntR	no	B	3	-7.79	-7.11	0.68
ACUAAG	UAUCG	11ntR	no	B	3	-8.06	-7.12	0.94
CCUAAU	UAUCG	11ntR	no	B	3	-7.42	-7.26	0.16
CGUAAG	UAUCG	11ntR	no	B	3	-7.44	-7.12	0.31
GCUAAG	UAUCG	11ntR	no	B	3	-8.22	-7.10	1.12
CCUUAG	UAUGA	11ntR	no	B	3	-7.38	-7.23	0.16
CGUAAG	UAUGA	11ntR	no	B	3	-8.04	-7.10	0.94
CUUAAG	UAUGA	11ntR	no	B	3	-7.94	-7.10	0.84
CCUAAU	UAUGC	11ntR	no	B	3	-8.31	-7.37	0.94
CUUAAG	UAUGC	11ntR	no	B	3	-7.96	-7.10	0.86
ACUGAG	UAUGG	11ntR	no	B	3	-7.93	-7.10	0.83
CAUAAA	UAUGG	11ntR	no	B	3	-8.01	-7.15	0.86
CAUACG	UAUGG	11ntR	no	B	3	-8.10	-7.10	1.00
CCUAGA	UAUGG	11ntR	no	B	3	-8.19	-7.82	0.38
CCUCAU	UAUGG	11ntR	no	B	3	-8.87	-7.83	1.04
CCUCGG	UAUGG	11ntR	no	B	3	-8.59	-7.75	0.84
CCUUGG	UAUGG	11ntR	no	B	3	-8.16	-7.43	0.73
CGUAAC	UAUGG	11ntR	no	B	3	-7.60	-7.11	0.49
GAUAAG	UAUGG	11ntR	no	B	3	-8.27	-7.14	1.12
GCUUAG	UAUGG	11ntR	no	B	3	-8.51	-7.60	0.90
UAUAAG	UAUGG	11ntR	no	B	3	-7.69	-7.18	0.51
UCUCAG	UAUGG	11ntR	no	B	3	-7.83	-7.15	0.68
CCUAAU	UAUGU	11ntR	no	B	3	-8.00	-7.12	0.88
CCUGAG	UAUGU	11ntR	no	B	3	-7.37	-7.16	0.22
CGUAAG	UAUGU	11ntR	no	B	3	-8.17	-7.14	1.03
CUUAAG	UAUGU	11ntR	no	B	3	-8.13	-7.10	1.03
ACUAAG	UAUUG	11ntR	no	B	3	-7.67	-7.10	0.57
CGUAAG	UAUUG	11ntR	no	B	3	-7.83	-7.27	0.56
GCUAAG	UAUUG	11ntR	no	B	3	-7.81	-7.10	0.71
CCUAAC	UCUGG	11ntR	no	B	3	-8.05	-7.18	0.87
CCUACG	UCUGG	11ntR	no	B	3	-8.07	-7.56	0.51
CCUAUG	UCUGG	11ntR	no	B	3	-7.87	-7.62	0.24
CCUCAG	UCUGG	11ntR	no	B	3	-8.56	-7.72	0.84
CCUGUG	UCUGG	11ntR	no	B	3	-7.78	-7.19	0.59
UCUAAG	UCUGG	11ntR	no	B	3	-7.38	-7.23	0.15
CCUAAG	UGUGG	11ntR	no	B	3	-7.54	-7.36	0.17
CCUAGG	UGUGG	11ntR	no	B	3	-7.71	-7.59	0.12
CCUCAG	UGUGG	11ntR	no	B	3	-8.13	-7.63	0.50
CCUUAG	UGUGG	11ntR	no	B	3	-8.20	-7.29	0.91
CCUAUG	UUUGG	11ntR	no	B	3	-7.58	-7.50	0.08
CCUCAG	UUUGG	11ntR	no	B	3	-8.49	-7.63	0.86
CCUUAG	UUUGG	11ntR	no	B	3	-7.87	-7.24	0.63
GCUAUA	CAUGC	11ntR	no	B	3	-8.48	-7.54	0.94
CCUAUG	UAUGG	11ntR	no	B	3	-8.96	-8.07	0.89
CCCUACC	GAUGG	12ntR	no	B	3	-8.72	-8.34	0.38
CCUAAG	CAGGG	11ntR	no	B	3	-8.50	-7.82	0.68
CCUGCAC	GUUGG	C7.2	no	B	3	-8.52	-7.69	0.83

CCUAGG	AAUGG	11ntR	no	B	3	-8.65	-7.76	0.89
CCUGUG	UUUGG	11ntR	no	B	3	-7.63	-7.36	0.27
CCUGAG	AAUGG	11ntR	no	B	3	-8.78	-7.82	0.96
CCUGUAC	GAAGG	C7.2	no	B	3	-8.29	-7.96	0.33
UCUAGG	UAUGA	11ntR	no	B	3	-8.05	-7.18	0.87
GCUAGG	UAUGC	11ntR	no	B	3	-7.83	-7.10	0.72
CCCUAAC	AAUGG	12ntR	no	B	3	-8.28	-7.91	0.37
CCGAAA	CAUGG	11ntR	no	B	3	-8.23	-7.72	0.51
CCUAGA	CAUGG	11ntR	no	B	3	-8.17	-7.50	0.67
CCUAGG	CAUGG	11ntR	no	B	3	-8.11	-7.75	0.36
CCUACC	CCUGG	11ntR	no	B	3	-8.08	-7.40	0.68
CCUACC	CUUGG	11ntR	no	B	3	-8.36	-7.55	0.81
ACCCAAC	GAGGG	12ntR	no	B	3	-8.66	-8.61	0.04
CCCUAAC	GCCGG	12ntR	no	B	3	-8.29	-7.55	0.74
CCCUAAC	GCUGG	12ntR	no	B	3	-8.55	-7.79	0.76
CCUGUAC	GUUGG	C7.2	no	B	3	-8.19	-7.68	0.51
CCUGAG	UACGG	11ntR	no	B	3	-8.38	-7.79	0.59
CCUAAU	UAUAG	11ntR	no	B	3	-7.41	-7.28	0.13
CCUAGC	UAUGG	11ntR	no	B	3	-8.31	-7.40	0.90
GCUAAG	UCUGC	11ntR	no	B	3	-7.34	-7.16	0.18
CCUAAU	UUUGG	11ntR	no	B	3	-8.50	-7.99	0.51
CCUGUAC	GCUGG	C7.2	no	B	3	-7.72	-7.22	0.50
CCCUAAC	GUGAG	12ntR	no	B	3	-7.92	-7.24	0.68
CUUAAG	UAUUG	11ntR	no	B	3	-8.14	-7.10	1.04
CCUGUAC	GACGG	C7.2	no	B	3	-7.54	-7.26	0.27
CCCGCC	AAUGG	11ntR	no	B	3	-8.10	-7.79	0.31
CCUAAAC	AUAGG	12ntR	yes	B	3	-8.63	-8.41	0.22
CCCUAAG	GACGG	12ntR	no	B	3	-8.91	-8.19	0.72
CCCCAAG	GAGGG	12ntR	no	B	3	-9.56	-9.03	0.53
CCCUAAC	GAUGG	12ntR	no	B	3	-8.40	-7.83	0.56
CCCUUAC	GAUGG	12ntR	no	B	3	-7.52	-7.36	0.16
CCUCAG	GAUGG	11ntR	no	B	3	-8.66	-7.71	0.94
CCCUAAC	GCGGG	12ntR	no	B	3	-8.99	-8.73	0.26
CCUAAU	UGUGG	11ntR	no	B	3	-7.59	-7.20	0.39
CCUAAA	CGUGG	11ntR	no	B	3	-7.67	-7.27	0.39
CCCGAAA	GAGGG	12ntR	no	B	3	-9.24	-8.46	0.78
CCUACG	CAAGG	11ntR	no	B	3	-8.73	-8.08	0.65
CCUCCC	AAUGG	11ntR	no	B	3	-8.48	-7.77	0.71
CCCUAAC	CAAGG	12ntR	no	B	3	-8.38	-7.58	0.80
CCGGAAC	GAGGG	12ntR	no	B	3	-8.78	-7.89	0.89
CCGUAAC	GAUGG	12ntR	no	B	3	-8.77	-8.13	0.64
CCUAGG	GAUGG	11ntR	no	B	3	-8.39	-7.78	0.60
CCCUAAC	GGGUG	12ntR	no	B	3	-7.54	-7.51	0.04
CCUAAAU	GUAGG	12ntR	no	B	3	-8.72	-8.61	0.11
CCUAACC	GUAGG	12ntR	no	B	3	-8.45	-8.12	0.33
CCUAAAC	UAAGG	12ntR	no	B	3	-9.07	-7.86	1.21
CCUAGG	UACGG	11ntR	no	B	3	-8.87	-7.73	1.14
CCUAAG	UAGGC	11ntR	no	B	3	-8.06	-7.36	0.70
CCUCAG	CAUGG	11ntR	no	B	3	-8.51	-7.66	0.85
CCUUAAC	GAAGG	12ntR	yes	B	3	-9.63	-8.60	1.03
CCUAAU	UCUGG	11ntR	no	B	3	-7.71	-7.48	0.24
CCUAAC	UUUGG	11ntR	no	B	3	-8.01	-7.56	0.45
CCGUAAC	GAAGG	12ntR	no	B	3	-8.67	-7.63	1.04
CCCGAAC	CAGGG	12ntR	no	B	3	-8.37	-7.86	0.51
CCUAAG	GAAGG	11ntR	no	B	3	-9.48	-8.20	1.28
CCCCGAC	GAGGG	12ntR	no	B	3	-8.91	-8.57	0.34
CCUAAAG	GUAGG	12ntR	no	B	3	-8.07	-7.95	0.12

CCUCAA	UAUGG	11ntR	no	B	3	-8.67	-7.84	0.83
CCUAAA	AAGGG	11ntR	no	B	3	-8.82	-7.68	1.14
CCUAAG	CCUGG	11ntR	no	B	3	-7.70	-7.31	0.38
CCUAAAC	GAUGG	12ntR	no	B	3	-9.21	-8.03	1.18
CCUAAAG	UUAGG	12ntR	no	B	3	-8.29	-8.03	0.26
CCGACG	CACGG	11ntR	no	B	3	-8.66	-7.82	0.85
CCCUUAC	GUGGG	12ntR	no	B	3	-8.74	-8.36	0.38
CCGUAAC	GAGGA	12ntR	no	B	3	-7.45	-7.21	0.24
CCGUAAG	GAGGG	12ntR	no	B	3	-7.78	-7.57	0.21
CCCGAAC	AAGGG	12ntR	no	B	3	-8.95	-8.42	0.52
CUUAAA	UAUGG	11ntR	no	B	3	-8.90	-7.78	1.12
CCUCAAC	GUAGG	12ntR	no	B	3	-9.07	-7.90	1.17
CCGUAAC	GACGG	12ntR	yes	B	3	-8.39	-8.17	0.22
CCUAAG	AACGG	11ntR	no	B	3	-9.14	-8.15	0.99
CCCUAAA	GAUGG	12ntR	no	B	3	-8.26	-7.84	0.42
CCUUCG	CACGG	11ntR	no	B	3	-8.52	-7.54	0.98
CCUUAG	CAUGG	11ntR	no	B	3	-8.68	-7.43	1.26
CCCUAAC	GAGGG	12ntR	yes	B	3	-9.36	-8.50	0.86
CCUGAAC	GUAGG	12ntR	no	B	3	-8.81	-8.12	0.69
CCUAAAG	UUUGG	12ntR	no	B	3	-8.86	-8.26	0.60
CCCCUAC	GAGGG	12ntR	no	B	3	-9.55	-8.70	0.85
CCCUAAU	GAGGG	12ntR	no	B	3	-8.99	-8.69	0.30
CCUAAAC	GUAGG	12ntR	yes	B	3	-8.91	-8.26	0.65
CCGGCC	AAUGG	11ntR	no	B	4	-7.37	-7.66	-0.28
CCAAAC	CACGG	11ntR	no	B	4	-7.59	-7.63	-0.04
CCAACG	CACGG	11ntR	no	B	4	-7.33	-7.79	-0.46
CCCAAC	CACGG	11ntR	no	B	4	-8.03	-7.57	0.46
CCUAGG	CACGG	11ntR	no	B	4	-8.42	-8.51	-0.09
CCAUAAC	CAGGG	12ntR	no	B	4	-7.39	-8.00	-0.61
CCCUGAC	CAGGG	12ntR	no	B	4	-7.22	-8.42	-1.20
CCUUAAC	CAGGG	12ntR	no	B	4	-7.45	-7.78	-0.33
GCGAAA	CAUGC	11ntR	no	B	4	-7.48	-7.33	0.15
CCAAAA	CAUGG	11ntR	no	B	4	-7.25	-7.77	-0.52
CCCACC	CAUGG	11ntR	no	B	4	-7.82	-7.71	0.10
CCGACC	CAUGG	11ntR	no	B	4	-7.78	-7.76	0.02
CUUAAG	CAUGG	11ntR	no	B	4	-7.30	-7.37	-0.07
CCUAAC	CCCGG	11ntR	no	B	4	-7.53	-7.38	0.15
CCUACC	CCCGG	11ntR	no	B	4	-7.82	-7.70	0.12
CCUAAC	CGCGG	11ntR	no	B	4	-7.60	-7.54	0.06
CCUACC	CGCGG	11ntR	no	B	4	-7.58	-7.73	-0.15
CCUAAAC	CUAGG	12ntR	no	B	4	-7.36	-8.06	-0.70
CCUAAC	CUCGG	11ntR	no	B	4	-7.27	-7.30	-0.02
CCUACC	CUCGG	11ntR	no	B	4	-8.05	-7.32	0.73
ACCUAAC	GAAGG	12ntR	no	B	4	-8.99	-9.26	-0.26
CCCAAAC	GAAGG	12ntR	no	B	4	-7.94	-8.34	-0.40
CCCUACC	GAAGG	12ntR	no	B	4	-7.72	-8.26	-0.54
CCCUCAC	GAAGG	12ntR	no	B	4	-8.19	-8.17	0.02
GCCUAAC	GAAGG	12ntR	no	B	4	-9.05	-9.40	-0.35
ACCUAAC	GACGG	12ntR	no	B	4	-8.45	-8.27	0.18
CACUAAC	GACGG	12ntR	no	B	4	-7.29	-7.21	0.08
CCCUAAA	GACGG	12ntR	no	B	4	-8.20	-7.86	0.34
CCCUAAC	GACGG	12ntR	no	B	4	-7.88	-7.73	0.15
CCCUAAU	GACGG	12ntR	no	B	4	-8.78	-8.32	0.46
CCCUACC	GACGG	12ntR	no	B	4	-8.33	-7.90	0.44
CCCUAGC	GACGG	12ntR	no	B	4	-8.04	-8.42	-0.38
CCCUGAC	GACGG	12ntR	no	B	4	-7.60	-7.75	-0.15
UCCUAAC	GACGG	12ntR	no	B	4	-8.63	-8.77	-0.14

CCCAAAC	GAGAG	12ntR	no	B	4	-7.30	-7.33	-0.03
CCUUAAC	GAGAG	12ntR	no	B	4	-7.18	-7.31	-0.13
UCCUAAC	GAGAG	12ntR	no	B	4	-7.11	-7.41	-0.30
CCCUAAU	GAGCG	12ntR	no	B	4	-7.26	-7.48	-0.22
CCGUAAC	GAGCG	12ntR	no	B	4	-7.31	-7.31	0.01
UCCUAAC	GAGCG	12ntR	no	B	4	-7.19	-7.58	-0.39
ACCUAGC	GAGGG	12ntR	no	B	4	-7.29	-8.11	-0.83
ACCUAUC	GAGGG	12ntR	no	B	4	-7.38	-7.79	-0.41
ACCUGAC	GAGGG	12ntR	no	B	4	-7.15	-7.50	-0.35
CACAAAC	GAGGG	12ntR	no	B	4	-7.11	-7.38	-0.28
CCAUAGC	GAGGG	12ntR	no	B	4	-7.47	-8.13	-0.67
CCAUGAC	GAGGG	12ntR	no	B	4	-7.76	-8.44	-0.68
CCGUAGC	GAGGG	12ntR	no	B	4	-7.73	-8.15	-0.42
CCGUAUC	GAGGG	12ntR	no	B	4	-7.73	-7.90	-0.17
CCGUGAC	GAGGG	12ntR	no	B	4	-7.52	-8.04	-0.52
CCGUUAC	GAGGG	12ntR	no	B	4	-7.57	-7.61	-0.04
CCUCAAC	GAGGG	12ntR	no	B	4	-7.75	-8.77	-1.02
CCUGAAC	GAGGG	12ntR	no	B	4	-7.51	-8.27	-0.77
CCUGCAC	GAGGG	C7.2	no	B	4	-7.73	-8.32	-0.60
CCUUAGC	GAGGG	12ntR	no	B	4	-7.38	-8.04	-0.66
CCUUCAC	GAGGG	12ntR	no	B	4	-7.48	-8.07	-0.59
CCUUUAC	GAGGG	12ntR	no	B	4	-7.31	-7.83	-0.52
CGCAAAC	GAGGG	12ntR	no	B	4	-7.33	-7.98	-0.64
GCAUAAC	GAGGG	12ntR	no	B	4	-7.39	-8.12	-0.73
GCCUAGC	GAGGG	12ntR	no	B	4	-8.14	-8.76	-0.62
GCGUAAC	GAGGG	12ntR	no	B	4	-7.23	-7.70	-0.48
GCUUAAC	GAGGG	12ntR	no	B	4	-7.25	-8.53	-1.28
UACUAAC	GAGGG	12ntR	no	B	4	-7.14	-7.22	-0.08
UCAUAAC	GAGGG	12ntR	no	B	4	-7.24	-7.85	-0.61
UCCUAGC	GAGGG	12ntR	no	B	4	-7.61	-8.03	-0.42
UCGUAAC	GAGGG	12ntR	no	B	4	-7.39	-7.64	-0.25
CACUAAC	GAGGU	12ntR	no	B	4	-7.21	-7.65	-0.44
CCGUAAC	GAGUG	12ntR	no	B	4	-7.71	-7.51	0.20
CCUUAAC	GAGUG	12ntR	no	B	4	-7.34	-7.24	0.11
GCCUAAC	GAGUG	12ntR	no	B	4	-7.18	-7.19	-0.01
UCCUAAC	GAGUG	12ntR	no	B	4	-7.28	-7.72	-0.44
CCCAAAC	GAUGG	12ntR	no	B	4	-8.02	-8.51	-0.48
CCCCAAC	GAUGG	12ntR	no	B	4	-8.50	-8.40	0.10
CCCGCAC	GAUGG	C7.2	no	B	4	-8.09	-8.03	0.06
CCCGUAC	GAUGG	C7.2	no	B	4	-7.68	-7.87	-0.19
CCCUGAC	GAUGG	12ntR	no	B	4	-7.58	-7.62	-0.04
CCCUAAC	GGAGG	12ntR	no	B	4	-7.81	-8.03	-0.22
CCCUAAC	GGCGG	12ntR	no	B	4	-7.89	-7.82	0.07
ACCUAAC	GGGGG	12ntR	no	B	4	-7.15	-7.46	-0.31
CCGUAAC	GGGGG	12ntR	no	B	4	-7.74	-7.68	0.06
CCCUAAC	GGUGG	12ntR	no	B	4	-7.84	-7.86	-0.02
CCCUAAC	GUAGG	12ntR	no	B	4	-7.44	-7.76	-0.31
ACCUAAC	GUGGG	12ntR	no	B	4	-7.26	-8.03	-0.77
CCUAAAG	GUUGG	12ntR	no	B	4	-8.38	-8.46	-0.08
CCUAAG	GUUGG	11ntR	no	B	4	-7.65	-8.09	-0.44
CCCUAAC	UAAGG	12ntR	no	B	4	-7.45	-7.58	-0.13
CCUAGG	UAAGG	11ntR	no	B	4	-7.42	-7.86	-0.44
CCUAUG	UAAGG	11ntR	no	B	4	-7.87	-8.39	-0.52
CCUCAG	UAAGG	11ntR	no	B	4	-7.45	-7.77	-0.32
CCAACG	UACGG	11ntR	no	B	4	-7.33	-7.41	-0.08
CCCACG	UACGG	11ntR	no	B	4	-7.55	-7.58	-0.03
CCGACG	UACGG	11ntR	no	B	4	-7.37	-7.65	-0.28

CCUAAG	UAGAG	11ntR	no	B	4	-7.19	-7.32	-0.13
CCUAAG	UAGCG	11ntR	no	B	4	-7.21	-7.46	-0.25
CCGUAAC	UAGGG	12ntR	no	B	4	-7.33	-7.37	-0.04
CCUAGG	UAGGG	11ntR	no	B	4	-7.28	-7.55	-0.26
CCUCAG	UAGGG	11ntR	no	B	4	-7.10	-7.85	-0.75
CCUUAAC	UAGGG	12ntR	no	B	4	-7.11	-7.58	-0.48
CUCUAAC	UAGGG	12ntR	no	B	4	-7.28	-7.14	0.15
CCUAAG	UAGUG	11ntR	no	B	4	-7.30	-7.62	-0.32
GCUAAG	UAUAG	11ntR	no	B	4	-7.25	-7.38	-0.13
UCUAAG	UAUAG	11ntR	no	B	4	-7.45	-7.43	0.02
ACCAAG	UAUGG	11ntR	no	B	4	-7.17	-7.92	-0.76
CAUGAG	UAUGG	11ntR	no	B	4	-7.16	-7.24	-0.08
CCAACG	UAUGG	11ntR	no	B	4	-7.17	-7.67	-0.51
CCCAAC	UAUGG	11ntR	no	B	4	-7.45	-7.58	-0.13
CCCAAG	UAUGG	11ntR	no	B	4	-7.16	-7.32	-0.16
CCCACG	UAUGG	11ntR	no	B	4	-7.52	-7.94	-0.42
CCCAGG	UAUGG	11ntR	no	B	4	-7.19	-7.64	-0.45
CCCAUG	UAUGG	11ntR	no	B	4	-7.34	-8.04	-0.70
CCCCAG	UAUGG	11ntR	no	B	4	-7.22	-7.53	-0.31
CCCGUG	UAUGG	11ntR	no	B	4	-7.18	-7.62	-0.43
CCGAAA	UAUGG	11ntR	no	B	4	-7.53	-7.65	-0.12
CCGAAC	UAUGG	11ntR	no	B	4	-7.15	-7.49	-0.34
CCGAAG	UAUGG	11ntR	no	B	4	-7.19	-7.70	-0.52
CCGAGG	UAUGG	11ntR	no	B	4	-7.21	-7.42	-0.22
CCGAUG	UAUGG	11ntR	no	B	4	-7.10	-7.75	-0.65
CCGCAG	UAUGG	11ntR	no	B	4	-7.26	-7.86	-0.60
CCGGAG	UAUGG	11ntR	no	B	4	-7.24	-7.52	-0.29
CCGUAG	UAUGG	11ntR	no	B	4	-7.28	-7.36	-0.08
GCCAAG	UAUGG	11ntR	no	B	4	-7.23	-8.09	-0.86
GCGAAG	UAUGG	11ntR	no	B	4	-7.12	-7.55	-0.43
GCUAGG	UAUGG	11ntR	no	B	4	-7.53	-7.37	0.17
GGUAAG	UAUGG	11ntR	no	B	4	-7.22	-7.34	-0.13
UCCAAG	UAUGG	11ntR	no	B	4	-7.37	-8.40	-1.03
UCUAUG	UAUGG	11ntR	no	B	4	-7.15	-7.33	-0.18
CCUAAG	UCUGG	11ntR	no	B	4	-7.86	-7.73	0.14
CCUAGG	UCUGG	11ntR	no	B	4	-7.19	-7.72	-0.52
GCUAAG	UCUGG	11ntR	no	B	4	-7.10	-7.34	-0.24
CCUACG	UGCGG	11ntR	no	B	4	-7.14	-7.84	-0.70
CCUAAG	UGGGG	11ntR	no	B	4	-7.10	-7.55	-0.45
CCAAAG	UGUGG	11ntR	no	B	4	-7.31	-7.55	-0.24
CCGAAG	UGUGG	11ntR	no	B	4	-7.20	-7.53	-0.32
CCUAAA	UGUGG	11ntR	no	B	4	-7.62	-8.16	-0.54
GCUAAG	UUUGC	11ntR	no	B	4	-7.14	-7.43	-0.29
CCUAAAC	UUUGG	12ntR	no	B	4	-7.57	-8.21	-0.64
CCUAAAC	GAGGG	12ntR	no	B	4	-7.99	-8.36	-0.37
CCCUAAC	GAAGG	12ntR	yes	B	4	-7.84	-7.98	-0.14
CCUUGAC	GAGGG	12ntR	no	B	4	-7.17	-8.13	-0.95
CCUAAG	UUGGG	11ntR	no	B	4	-7.12	-8.04	-0.92
CCGACG	UAUGG	11ntR	no	B	4	-7.47	-7.77	-0.29
CCAUACC	GAGGG	12ntR	no	B	4	-7.83	-8.00	-0.18
CCAUAAG	GAGGG	12ntR	no	B	4	-7.59	-7.91	-0.32
CCAUAAC	GUGGG	12ntR	no	B	4	-7.59	-7.92	-0.33
CCUAAAC	GUGGG	12ntR	no	B	4	-7.34	-8.05	-0.70
CCUCAG	UACGG	11ntR	no	B	4	-8.31	-8.03	0.28
CCCUAGC	GAAGG	12ntR	no	B	4	-7.59	-8.28	-0.69
CCUAAG	AAAGG	11ntR	no	B	4	-8.58	-8.48	0.10
CCCAAG	AAUGG	11ntR	no	B	4	-7.51	-8.20	-0.69

CCGAAG	AAUGG	11ntR	no	B	4	-7.64	-8.09	-0.45
CCAAAA	CACGG	11ntR	no	B	4	-7.53	-7.44	0.10
CCAACC	CACGG	11ntR	no	B	4	-7.59	-7.56	0.03
CCCAAA	CACGG	11ntR	no	B	4	-7.59	-7.70	-0.11
CCCGAAC	GAAGG	12ntR	no	B	4	-7.47	-7.87	-0.40
CCCCAAC	GACGG	12ntR	no	B	4	-7.90	-8.12	-0.21
CCCGAAC	GACGG	12ntR	no	B	4	-7.85	-7.62	0.24
CCAAAAC	GAGGG	12ntR	no	B	4	-8.05	-8.40	-0.35
CCAUAAU	GAGGG	12ntR	no	B	4	-8.02	-8.40	-0.38
CCGAAAC	GAGGG	12ntR	no	B	4	-8.03	-8.46	-0.44
CCUUAAC	GAGGG	12ntR	no	B	4	-7.51	-8.12	-0.61
CUCUUAC	GAGGG	12ntR	no	B	4	-7.28	-7.65	-0.36
CCCUAGC	GAUGG	12ntR	no	B	4	-7.80	-7.89	-0.08
CCGAAG	GAUGG	11ntR	no	B	4	-7.31	-7.64	-0.33
CCUAAG	GGUGG	11ntR	no	B	4	-7.66	-7.58	0.08
CCGGUG	UAUGG	11ntR	no	B	4	-7.61	-8.23	-0.62
CCUCUG	UAUGG	11ntR	no	B	4	-8.04	-7.75	0.29
CCUAAG	UCGGG	11ntR	no	B	4	-7.30	-7.59	-0.30
CCCAAG	UGUGG	11ntR	no	B	4	-7.41	-8.18	-0.77
CCUAAC	UGUGG	11ntR	no	B	4	-7.79	-8.02	-0.22
CCUAUG	UGUGG	11ntR	no	B	4	-7.14	-7.74	-0.60
CCUAAG	UUAGG	11ntR	no	B	4	-7.42	-8.11	-0.69
CCGAAG	UUUGG	11ntR	no	B	4	-7.10	-7.92	-0.82
CCUUAAC	GACGG	12ntR	no	B	4	-7.94	-8.09	-0.15
CCAAAAC	GUAGG	12ntR	no	B	4	-7.41	-8.06	-0.65
CCUAAG	AAGGG	11ntR	no	B	4	-8.22	-8.14	0.08
CUCAAAC	GAGGG	12ntR	no	B	4	-7.10	-7.56	-0.46
GCCCAAC	GAGGG	12ntR	no	B	4	-8.50	-8.96	-0.46
CCUAAA	CUCGG	11ntR	no	B	4	-7.34	-7.43	-0.09
CGCUGAC	GAGGG	12ntR	no	B	4	-7.13	-7.92	-0.80
CCUAAA	UCUGG	11ntR	no	B	4	-7.30	-7.42	-0.12
CGCUAAC	GAGGC	12ntR	no	B	4	-7.24	-7.90	-0.66
CCAUAAC	GGGGG	12ntR	no	B	4	-7.16	-7.55	-0.39
CCGUAAC	AAGGG	12ntR	no	B	4	-7.36	-7.53	-0.17
CCUAAG	ACUGG	11ntR	no	B	4	-8.56	-8.14	0.42
CCGACC	CACGG	11ntR	no	B	4	-7.91	-7.83	0.07
CCUACC	CGUGG	11ntR	no	B	4	-7.74	-8.38	-0.64
CCUAAA	CUUGG	11ntR	no	B	4	-8.12	-7.95	0.17
CCAUAAC	GAAGG	12ntR	no	B	4	-7.61	-7.92	-0.31
UCCUAAC	GAAGG	12ntR	no	B	4	-9.50	-9.84	-0.34
CCAUAAC	GACGG	12ntR	no	B	4	-7.58	-7.79	-0.21
CCGUAAC	GAGAG	12ntR	no	B	4	-7.45	-7.42	0.03
CCAUCAC	GAGGG	12ntR	no	B	4	-7.43	-7.96	-0.53
CCGUAAU	GAGGG	12ntR	no	B	4	-8.20	-8.22	-0.02
CCGUACC	GAGGG	12ntR	no	B	4	-7.91	-7.92	-0.02
CCGUCAC	GAGGG	12ntR	no	B	4	-7.46	-8.28	-0.82
UCCCAAC	GAGGG	12ntR	no	B	4	-8.65	-8.93	-0.28
CCCAAAC	GUAGG	12ntR	no	B	4	-7.55	-8.24	-0.69
CCUAAGC	GUAGG	12ntR	no	B	4	-8.43	-8.56	-0.14
CCUACAC	GUAGG	12ntR	no	B	4	-8.10	-8.12	-0.02
CCCAAG	UACGG	11ntR	no	B	4	-7.40	-7.68	-0.28
CCCAAU	UAUGG	11ntR	no	B	4	-7.78	-8.03	-0.25
CCGAAU	UAUGG	11ntR	no	B	4	-7.12	-7.94	-0.82
CCUAGU	UAUGG	11ntR	no	B	4	-7.97	-7.62	0.35
CCUAAG	UCAGG	11ntR	no	B	4	-7.80	-7.88	-0.08
CCUACG	UCCGG	11ntR	no	B	4	-7.31	-7.78	-0.47
CCCCAAC	GAGAG	12ntR	no	B	4	-7.12	-7.13	0.00

CCAGCAC	GAUGG	C7.2	no	B	4	-7.37	-8.03	-0.66
CCCUUAC	GACGG	12ntR	no	B	4	-7.31	-7.81	-0.50
CCGUAAC	GAGGG	12ntR	no	B	4	-7.66	-7.85	-0.19
GCCAAAC	GAGGG	12ntR	no	B	4	-8.03	-8.85	-0.82
CCAUAAC	GCGGG	12ntR	no	B	4	-7.66	-8.09	-0.43
CCUUAAC	GGGGG	12ntR	no	B	4	-7.18	-7.67	-0.49
CCUAAC	GUUGG	11ntR	no	B	4	-7.24	-7.96	-0.71
CCUACG	CCCGG	11ntR	no	B	4	-7.95	-7.75	0.20
CCCCAAC	GAAGG	12ntR	no	B	4	-7.76	-8.10	-0.34
CCAAAG	UAUGG	11ntR	no	B	4	-7.20	-7.76	-0.56
CCUACG	AAAGG	11ntR	no	B	4	-8.02	-8.17	-0.16
CCAGCC	AAUGG	11ntR	no	B	4	-7.89	-7.81	0.08
CCCACG	CACGG	11ntR	no	B	4	-7.63	-7.77	-0.14
CCGAAC	CACGG	11ntR	no	B	4	-7.78	-7.72	0.06
CCAACC	CAUGG	11ntR	no	B	4	-7.40	-7.83	-0.44
CCCAAAC	GACGG	12ntR	no	B	4	-7.57	-8.11	-0.54
CCAUUAC	GAGGG	12ntR	no	B	4	-7.46	-7.80	-0.34
CCCCAGC	GAGGG	12ntR	no	B	4	-8.24	-8.72	-0.47
CCUGUAC	GAGGG	C7.2	no	B	4	-7.45	-7.66	-0.20
UCUUAAC	GAGGG	12ntR	no	B	4	-7.88	-7.29	0.59
CCCAAG	GAUGG	11ntR	no	B	4	-7.60	-8.08	-0.48
CCUAAG	GCUGG	11ntR	no	B	4	-8.37	-8.57	-0.20
CCUAAAC	GGAGG	12ntR	no	B	4	-8.75	-8.38	0.38
CCCUAAC	GUCGG	12ntR	no	B	4	-8.09	-7.92	0.17
CCCAAA	UAUGG	11ntR	no	B	4	-7.31	-7.45	-0.14
CCAAAG	UCUGG	11ntR	no	B	4	-7.25	-7.78	-0.53
CCCAAG	UCUGG	11ntR	no	B	4	-7.50	-8.00	-0.50
CCUACG	UUCGG	11ntR	no	B	4	-7.32	-7.52	-0.20
CCAAAC	UAUGG	11ntR	no	B	4	-7.11	-7.53	-0.42
CCCUAAU	GAAGG	12ntR	no	B	4	-8.36	-8.76	-0.40
CCCUGAC	GAAGG	12ntR	no	B	4	-7.22	-7.56	-0.34
CCCAAGC	GAGGG	12ntR	no	B	4	-8.03	-8.41	-0.38
CCGCAAC	GAGGG	12ntR	no	B	4	-7.76	-8.03	-0.28
CCGAAAC	GUAGG	12ntR	no	B	4	-7.73	-7.99	-0.26
CCUAAAA	GUAGG	12ntR	no	B	4	-7.81	-8.02	-0.22
CCCGAAC	UAGGG	12ntR	no	B	4	-7.42	-7.64	-0.23
CCUAUA	UAUGG	11ntR	no	B	4	-7.40	-7.96	-0.56
CCGAAG	UCUGG	11ntR	no	B	4	-7.34	-7.86	-0.51
CCCUCAC	GACGG	12ntR	no	B	4	-8.02	-7.76	0.26
CCUUAG	UAAGG	11ntR	no	B	4	-7.35	-7.99	-0.65
CCCUAG	UAUGG	11ntR	no	B	4	-7.33	-7.70	-0.37
CCAUAAA	GAGGG	12ntR	no	B	4	-7.44	-7.78	-0.34
CCCUCAG	GAGGG	12ntR	no	B	4	-7.65	-8.35	-0.70
CCAUAAC	AAGGG	12ntR	no	B	4	-7.45	-7.91	-0.46
CCCUAGC	CAGGG	12ntR	no	B	4	-7.35	-8.26	-0.91
CCAUAAC	GAGUG	12ntR	no	B	4	-7.15	-7.45	-0.30
CCAAAG	GAUGG	11ntR	no	B	4	-7.21	-7.50	-0.30
CCCUAUC	GAUGG	12ntR	no	B	4	-8.01	-7.75	0.26
CCUAGAC	GUAGG	12ntR	no	B	4	-7.33	-7.94	-0.61
CCUAUAC	GUAGG	12ntR	no	B	4	-7.62	-8.12	-0.51
CCAAAG	UACGG	11ntR	no	B	4	-7.56	-7.55	0.01
CCAAAA	UAUGG	11ntR	no	B	4	-7.29	-7.65	-0.36
CCUAAG	UUUGG	11ntR	no	B	4	-7.32	-7.80	-0.49
CCCAAG	CAUGG	11ntR	no	B	4	-7.25	-8.01	-0.76
CCCUAUC	GAAGG	12ntR	no	B	4	-7.47	-7.91	-0.44
CCAGUAC	GAUGG	C7.2	no	B	4	-7.54	-7.78	-0.23
CCUAAG	GUAGG	11ntR	no	B	4	-7.27	-7.54	-0.28

CCCUGGC	GAGGG	12ntR	no	B	4	-7.67	-8.19	-0.52
CCUCCG	CACGG	11ntR	no	B	4	-8.43	-8.38	0.05
CCUAUG	CACGG	11ntR	no	B	4	-7.64	-7.51	0.12
CCCACC	CACGG	11ntR	no	B	4	-8.15	-8.24	-0.09
CCUACG	UGUGG	11ntR	no	B	4	-7.43	-8.07	-0.65
CCUUAAG	GAGGG	12ntR	no	B	4	-7.58	-8.33	-0.75
CCAAAG	UAGGG	11ntR	no	B	4	-7.57	-7.82	-0.25
CCUAAG	UCCGG	11ntR	no	B	4	-7.38	-8.12	-0.74
CCUAAG	CGUGG	11ntR	no	B	4	-7.22	-7.59	-0.36
CCUAAC	GUAGG	11ntR	no	B	4	-7.24	-7.80	-0.55
CCUAAUC	GUAGG	12ntR	no	B	4	-7.45	-7.70	-0.26
UCCUGAC	GAGGA	12ntR	no	B	4	-7.80	-7.88	-0.08
CCAGAAC	GAGGG	12ntR	no	B	4	-8.13	-8.33	-0.20
CCUAAC	GAAGG	11ntR	no	B	4	-8.27	-8.66	-0.40
CCUAAG	UGAGG	11ntR	no	B	4	-7.46	-7.66	-0.20
CCGAAG	UACGG	11ntR	no	B	4	-7.44	-7.86	-0.42
CCGAAG	CAUGG	11ntR	no	B	4	-7.67	-7.51	0.16
CCUAAAC	GAAGG	12ntR	no	B	4	-8.09	-8.10	-0.01
CCUAAAC	GUCGG	12ntR	no	B	4	-8.03	-7.96	0.07
CCUACG	CGCGG	11ntR	no	B	4	-7.47	-7.84	-0.36
CACUAAC	GAGUG	12ntR	no	B	4	-7.21	-7.82	-0.61
CCCUAAC	GUUGG	12ntR	no	B	4	-7.90	-8.01	-0.10
CCUAAC	UUAGG	11ntR	no	B	4	-7.35	-7.84	-0.49
CCAAAG	CAUGG	11ntR	no	B	4	-7.51	-8.01	-0.50
CCAAAU	UAUGG	11ntR	no	B	4	-7.47	-7.54	-0.07
CCUAAAC	GUUGG	12ntR	no	B	4	-8.12	-8.39	-0.28
CCUAAG	CAAGG	11ntR	no	B	4	-8.75	-8.66	0.10
CCUAAAC	UUAGG	12ntR	no	B	4	-7.26	-7.88	-0.62
CCUAAA	UUUGG	11ntR	no	B	4	-7.87	-7.96	-0.10
CCAUAAC	GAGGG	12ntR	no	B	4	-7.77	-7.82	-0.05
CCCAUAC	GAGGG	12ntR	no	B	4	-8.34	-7.85	0.49
CCCAGAC	GAGGG	12ntR	no	B	4	-7.83	-8.31	-0.48
CCCUAAU	UAGGG	12ntR	no	B	4	-7.86	-8.62	-0.76
CCCUAAC	AAGGA	12ntR	no	B	5	-8.05	-8.71	-0.66
CCUAAA	AAGGA	11ntR	no	B	5	-7.50	-7.40	0.09
CCUAAG	AAGGA	11ntR	no	B	5	-7.33	-7.48	-0.15
CCUACG	AAGGA	11ntR	no	B	5	-7.44	-7.61	-0.17
CCCUAAC	AAGGC	12ntR	no	B	5	-7.61	-8.37	-0.76
CACUAAC	AAGGG	12ntR	no	B	5	-7.56	-7.70	-0.13
CGCUAAC	AAGGG	12ntR	no	B	5	-8.49	-9.06	-0.57
CUCUAAC	AAGGG	12ntR	no	B	5	-7.74	-8.13	-0.39
UCCUAAC	AAGGG	12ntR	no	B	5	-8.62	-8.81	-0.19
CCCUAAC	AAGGU	12ntR	no	B	5	-7.42	-7.98	-0.56
CCCUAAC	CAGGA	12ntR	no	B	5	-7.38	-8.08	-0.70
CCCUAAC	CAGGC	12ntR	no	B	5	-7.41	-7.77	-0.36
CCCUAAC	CAGGG	12ntR	no	B	5	-8.52	-8.77	-0.25
GCCUAAC	CAGGG	12ntR	no	B	5	-9.57	-8.81	0.77
UCCUAAC	CAGGG	12ntR	no	B	5	-8.51	-7.79	0.72
CCCUAAC	CAGGU	12ntR	no	B	5	-7.26	-7.53	-0.27
CCUAAA	CCUGG	11ntR	no	B	5	-7.71	-7.63	0.08
GCUAAA	CUUGC	11ntR	no	B	5	-7.26	-7.41	-0.16
CCCUAAG	GAAGG	12ntR	no	B	5	-7.73	-9.16	-1.43
CCCUUAC	GAAGG	12ntR	no	B	5	-8.04	-8.31	-0.27
CUCUAAC	GAAGG	12ntR	no	B	5	-7.25	-7.38	-0.12
UUCCAAC	GAGAA	12ntR	no	B	5	-7.21	-7.57	-0.36
CCCGAAC	GAGAG	12ntR	no	B	5	-7.22	-7.50	-0.28
ACCUAAC	GAGGA	12ntR	no	B	5	-7.47	-7.97	-0.50

CCCAAAC	GAGGA	12ntR	no	B	5	-7.31	-7.57	-0.26
CCCCAAC	GAGGA	12ntR	no	B	5	-7.75	-8.25	-0.49
CCCUAAC	GAGGA	12ntR	no	B	5	-7.73	-8.52	-0.80
CCCUAAU	GAGGA	12ntR	no	B	5	-7.71	-8.83	-1.12
CCCUACC	GAGGA	12ntR	no	B	5	-7.93	-8.60	-0.67
CCCUAGC	GAGGA	12ntR	no	B	5	-7.58	-8.03	-0.44
CCCUCAC	GAGGA	12ntR	no	B	5	-7.65	-8.10	-0.45
CCCUUAC	GAGGA	12ntR	no	B	5	-7.41	-7.90	-0.48
GCCUAAC	GAGGA	12ntR	no	B	5	-7.89	-8.33	-0.44
UCCGAAC	GAGGA	12ntR	no	B	5	-8.99	-9.89	-0.91
UUCUAAC	GAGGA	12ntR	yes	B	5	-7.80	-8.08	-0.28
CCCGAAC	GAGGC	12ntR	no	B	5	-7.83	-8.54	-0.71
CCCUAAA	GAGGC	12ntR	no	B	5	-7.24	-7.87	-0.63
CCCUAAC	GAGGC	12ntR	no	B	5	-7.69	-8.16	-0.47
CCCUAAU	GAGGC	12ntR	no	B	5	-7.73	-8.33	-0.61
CCCUACC	GAGGC	12ntR	no	B	5	-7.68	-8.37	-0.69
CCCUAGC	GAGGC	12ntR	no	B	5	-7.43	-7.68	-0.25
CCCUAUC	GAGGC	12ntR	no	B	5	-7.45	-8.49	-1.04
CCCUCAC	GAGGC	12ntR	no	B	5	-7.44	-7.75	-0.31
CCCUGAC	GAGGC	12ntR	no	B	5	-7.33	-7.54	-0.22
CCCUUAC	GAGGC	12ntR	no	B	5	-7.35	-7.54	-0.19
UCCUAAC	GAGGC	12ntR	no	B	5	-7.36	-7.58	-0.22
ACCAAAC	GAGGG	12ntR	no	B	5	-7.23	-7.51	-0.28
ACCGAAC	GAGGG	12ntR	no	B	5	-7.69	-8.69	-1.00
ACCUAAA	GAGGG	12ntR	no	B	5	-7.46	-7.71	-0.25
ACCUAAC	GAGGG	12ntR	no	B	5	-7.82	-8.23	-0.41
ACCUAAG	GAGGG	12ntR	no	B	5	-8.31	-7.65	0.66
ACCUAAU	GAGGG	12ntR	no	B	5	-7.96	-7.98	-0.01
ACCUACC	GAGGG	12ntR	no	B	5	-8.09	-8.51	-0.42
ACCUCAC	GAGGG	12ntR	no	B	5	-7.44	-7.93	-0.49
ACCUUAC	GAGGG	12ntR	no	B	5	-7.34	-8.76	-1.41
CACCAAC	GAGGG	12ntR	no	B	5	-7.46	-7.82	-0.36
CACGAAC	GAGGG	12ntR	no	B	5	-7.39	-8.19	-0.81
CACUAAC	GAGGG	12ntR	no	B	5	-7.48	-7.59	-0.11
CACUAAU	GAGGG	12ntR	no	B	5	-7.43	-7.54	-0.11
CACUACC	GAGGG	12ntR	no	B	5	-7.40	-7.73	-0.33
CCCGAGC	GAGGG	12ntR	no	B	5	-8.08	-8.88	-0.80
CCCUGAA	GAGGG	12ntR	no	B	5	-7.98	-8.53	-0.56
CCCUGAG	GAGGG	12ntR	no	B	5	-7.83	-8.54	-0.71
CCUUACC	GAGGG	12ntR	no	B	5	-7.80	-9.36	-1.56
CGCUAAG	GAGGG	12ntR	no	B	5	-7.64	-8.40	-0.76
CGCUAAU	GAGGG	12ntR	no	B	5	-7.70	-8.70	-1.00
CGCUACC	GAGGG	12ntR	no	B	5	-8.22	-8.92	-0.70
CGCUAGC	GAGGG	12ntR	no	B	5	-7.32	-7.85	-0.54
CGCUCAC	GAGGG	12ntR	no	B	5	-8.10	-8.37	-0.27
CGCUUAC	GAGGG	12ntR	no	B	5	-7.36	-8.00	-0.64
CUCCAAC	GAGGG	12ntR	no	B	5	-7.45	-7.86	-0.41
CUCUAAC	GAGGG	12ntR	no	B	5	-7.56	-8.06	-0.50
CUCUAAG	GAGGG	12ntR	no	B	5	-7.26	-7.56	-0.30
CUCUACC	GAGGG	12ntR	no	B	5	-7.51	-8.08	-0.57
GCCGAAC	GAGGG	12ntR	no	B	5	-9.07	-10.03	-0.96
GCCUAAA	GAGGG	12ntR	no	B	5	-8.25	-8.79	-0.53
GCCUAAU	GAGGG	12ntR	no	B	5	-8.76	-9.43	-0.67
GCCUAUC	GAGGG	12ntR	no	B	5	-8.25	-9.20	-0.95
GCCUUAC	GAGGG	12ntR	no	B	5	-7.94	-8.94	-1.00
UCCAAAC	GAGGG	12ntR	no	B	5	-7.58	-8.03	-0.45
UCCGAAC	GAGGG	12ntR	no	B	5	-8.13	-9.08	-0.95

UCCUAAA	GAGGG	12ntR	no	B	5	-7.76	-8.14	-0.37
UCCUAAC	GAGGG	12ntR	no	B	5	-8.60	-8.77	-0.17
UCCUAAG	GAGGG	12ntR	no	B	5	-8.25	-8.15	0.10
UCCUACC	GAGGG	12ntR	no	B	5	-8.87	-8.85	0.02
UCCUUAC	GAGGG	12ntR	no	B	5	-7.61	-8.23	-0.62
UGCUAAC	GAGGG	12ntR	no	B	5	-7.28	-7.74	-0.46
UUCUAAC	GAGGG	12ntR	no	B	5	-7.30	-7.53	-0.24
ACCUAAC	GAGGU	12ntR	no	B	5	-8.53	-8.99	-0.45
CCCCAAC	GAGGU	12ntR	no	B	5	-7.44	-7.73	-0.29
CCCGAAC	GAGGU	12ntR	no	B	5	-7.43	-8.00	-0.57
CCCUAAG	GAGGU	12ntR	no	B	5	-7.23	-7.70	-0.47
CCCUAAU	GAGGU	12ntR	no	B	5	-7.30	-7.93	-0.64
CCCUACC	GAGGU	12ntR	no	B	5	-7.39	-7.92	-0.53
CCCUAUC	GAGGU	12ntR	no	B	5	-7.21	-7.83	-0.63
CCCUUAC	GAGGU	12ntR	no	B	5	-7.14	-7.29	-0.15
CUCUAAC	GAGGU	12ntR	no	B	5	-7.18	-7.47	-0.30
GCCUAAC	GAGGU	12ntR	no	B	5	-8.68	-9.30	-0.62
UCCUAAC	GAGGU	12ntR	no	B	5	-8.48	-8.85	-0.37
CGCUAAC	GAGUG	12ntR	no	B	5	-7.26	-7.72	-0.46
CCCUCAC	GAUGG	12ntR	no	B	5	-8.01	-8.09	-0.08
CCGGCAC	GAUGG	C7.2	no	B	5	-7.97	-8.17	-0.20
CCGGUAC	GAUGG	C7.2	no	B	5	-7.72	-7.98	-0.26
CCUAAAC	GCAGG	12ntR	no	B	5	-8.68	-8.46	0.22
CCCUAAC	GCGGA	12ntR	no	B	5	-7.91	-8.45	-0.54
UCCUAAC	GCGGA	12ntR	no	B	5	-9.00	-9.34	-0.34
CCCUAAC	GCGGC	12ntR	no	B	5	-7.65	-8.18	-0.54
CCCUAUC	GCGGG	12ntR	no	B	5	-8.52	-8.95	-0.44
CCCUCAC	GCGGG	12ntR	no	B	5	-10.07	-9.45	0.61
CCCUGAC	GCGGG	12ntR	no	B	5	-7.65	-8.23	-0.58
CGCUAAC	GCGGG	12ntR	no	B	5	-8.43	-9.54	-1.11
GCCUAAC	GCGGG	12ntR	no	B	5	-8.70	-9.19	-0.49
CCCUAAC	GGGCG	12ntR	no	B	5	-7.87	-7.54	0.33
CGCUAAC	GGGGG	12ntR	no	B	5	-7.41	-8.01	-0.60
GCCUAAC	GGGGG	12ntR	no	B	5	-7.81	-8.64	-0.83
UCCUAAC	GGGGG	12ntR	no	B	5	-7.40	-7.69	-0.29
CCCUAAC	GUGGA	12ntR	no	B	5	-7.94	-8.82	-0.88
CCGUAAC	GUGGG	12ntR	no	B	5	-7.55	-7.53	0.02
CGCUAAC	GUGGG	12ntR	no	B	5	-7.39	-8.02	-0.63
CUCUAAC	GUGGG	12ntR	no	B	5	-7.58	-8.40	-0.81
GCCUAAC	GUGGG	12ntR	no	B	5	-8.26	-9.10	-0.85
UCCUAAC	GUGGG	12ntR	no	B	5	-8.29	-8.86	-0.57
CCCUAAC	GUGGU	12ntR	no	B	5	-7.43	-8.11	-0.68
UCUGAG	UACGA	11ntR	no	B	5	-7.78	-7.32	0.46
CCUGCG	UACGG	11ntR	yes	B	5	-8.24	-8.06	0.18
CCCUAAC	UAGGA	12ntR	no	B	5	-7.38	-8.06	-0.68
CCUAAG	UAGGA	11ntR	no	B	5	-7.55	-7.38	0.18
CCCUAAC	UAGGC	12ntR	no	B	5	-7.18	-7.61	-0.43
CCCCAAC	UAGGG	12ntR	no	B	5	-8.09	-8.58	-0.49
UCCUAAC	UAGGG	12ntR	no	B	5	-7.54	-7.64	-0.10
CCUGAG	UAUGA	11ntR	no	B	5	-7.73	-7.30	0.42
UCUCAG	UAUGA	11ntR	no	B	5	-7.93	-7.35	0.59
GCUCAG	UAUGC	11ntR	no	B	5	-7.74	-7.18	0.56
CCACAG	UAUGG	11ntR	no	B	5	-7.63	-7.87	-0.24
CCUAGG	UUUGG	11ntR	no	B	5	-8.06	-8.19	-0.13
CCUGAG	UUUGG	11ntR	no	B	5	-7.55	-7.53	0.02
CCCUGAC	GGGGG	12ntR	no	B	5	-7.77	-8.03	-0.26
GCCAAA	CAUGC	11ntR	no	B	5	-7.59	-7.47	0.11

CGCUAAC	GAAGG	12ntR	no	B	5	-7.42	-7.50	-0.08
CCCUAAG	GGGGG	12ntR	no	B	5	-8.40	-9.00	-0.61
CCUUAAC	AAGGG	12ntR	no	B	5	-7.46	-8.34	-0.88
CCCUCAC	CAGGG	12ntR	no	B	5	-8.13	-8.45	-0.32
CGCUAAC	CAGGG	12ntR	no	B	5	-8.21	-8.43	-0.22
CCCUAAC	CUGGG	12ntR	no	B	5	-8.06	-8.42	-0.36
CCUGCAC	GACGG	C7.2	no	B	5	-8.13	-8.33	-0.21
CCCUAAA	GAGGA	12ntR	no	B	5	-7.41	-8.13	-0.72
CCCUAAG	GAGGA	12ntR	no	B	5	-7.52	-8.45	-0.94
ACCUAAC	GAGGC	12ntR	no	B	5	-7.85	-8.41	-0.55
CCCUAAG	GAGGC	12ntR	no	B	5	-7.42	-8.03	-0.61
CCCUACC	GAGGG	12ntR	no	B	5	-9.08	-9.27	-0.18
CCCUGAU	GAGGG	12ntR	no	B	5	-8.05	-8.88	-0.83
CGCUAAC	GAGGG	12ntR	no	B	5	-8.20	-8.88	-0.68
UCCUGAC	GAGGG	12ntR	no	B	5	-7.50	-7.70	-0.20
CACUAAC	GCGGG	12ntR	no	B	5	-7.62	-7.78	-0.16
CCUUAAC	GCGGG	12ntR	no	B	5	-7.53	-8.17	-0.64
UCCUAAC	GCGGG	12ntR	no	B	5	-8.63	-8.50	0.13
CCCGAAC	GGGGG	12ntR	no	B	5	-8.51	-8.54	-0.04
CCCUAGC	GGGGG	12ntR	no	B	5	-8.69	-8.62	0.06
CCCUAAC	GGGGU	12ntR	no	B	5	-7.38	-7.27	0.11
CCUGCAC	GGUGG	C7.2	no	B	5	-8.03	-7.46	0.58
CCUGUAC	GGUGG	C7.2	no	B	5	-8.10	-7.57	0.53
UUCUAAC	GUGAA	12ntR	no	B	5	-7.83	-7.99	-0.16
CCCUAAC	GUGGC	12ntR	no	B	5	-7.68	-8.64	-0.97
CCCUACC	GUGGG	12ntR	no	B	5	-9.42	-8.87	0.55
CCCUAGC	GUGGG	12ntR	no	B	5	-8.87	-9.36	-0.49
UUCUAAC	AAGAA	12ntR	no	B	5	-7.43	-7.68	-0.25
UUCUAAC	GAGAA	12ntR	yes	B	5	-7.48	-7.79	-0.31
CCCCAAC	GAGGC	12ntR	no	B	5	-7.56	-8.16	-0.60
CCCGCAC	GAGGG	12ntR	no	B	5	-9.26	-8.66	0.60
CGCCAAC	GAGGG	12ntR	no	B	5	-7.66	-8.12	-0.46
CUCUAUC	GAGGG	12ntR	no	B	5	-7.32	-8.11	-0.78
GCCUAAC	GAGGG	12ntR	no	B	5	-8.92	-9.64	-0.72
GCCUAAG	GAGGG	12ntR	no	B	5	-8.77	-9.15	-0.38
GCCUCAC	GAGGG	12ntR	no	B	5	-8.52	-9.04	-0.52
GUCUAAC	GAGGG	12ntR	no	B	5	-7.50	-7.91	-0.41
CCCUAAG	GCGGG	12ntR	no	B	5	-9.37	-9.21	0.16
CCCUACC	GCGGG	12ntR	no	B	5	-9.95	-9.40	0.55
CUCUAAC	GCGGG	12ntR	no	B	5	-7.60	-8.21	-0.61
CCCUAAU	GGGGG	12ntR	no	B	5	-8.64	-8.95	-0.31
GCCUAAC	UAGGG	12ntR	no	B	5	-8.84	-8.67	0.17
CCCAAAC	GGGGG	12ntR	no	B	5	-8.60	-8.61	-0.02
UCCUUAC	GAGGA	12ntR	no	B	5	-8.21	-8.30	-0.09
CCCGUAC	GAGGG	12ntR	no	B	5	-8.56	-8.78	-0.22
CCCGAAC	GUGGG	12ntR	no	B	5	-8.83	-9.20	-0.37
CCCUAAA	GAAGG	12ntR	no	B	5	-7.76	-8.69	-0.93
CCCGAAC	GAGGA	12ntR	no	B	5	-7.76	-8.76	-1.00
CCCUAUC	GAGGA	12ntR	no	B	5	-7.58	-8.38	-0.81
CCCUGAC	GAGGA	12ntR	no	B	5	-7.33	-7.72	-0.39
UCCUCAC	GAGGA	12ntR	no	B	5	-8.58	-8.95	-0.37
CCCCCAC	GAGGG	12ntR	no	B	5	-9.23	-9.49	-0.26
CCCGAAG	GAGGG	12ntR	no	B	5	-9.44	-8.99	0.46
CCCUAAG	GAGGG	12ntR	no	B	5	-8.79	-8.85	-0.05
CUCGAAC	GAGGG	12ntR	no	B	5	-7.65	-8.64	-0.99
UCCUCAC	GAGGG	12ntR	no	B	5	-8.03	-8.06	-0.03
ACCUAAC	GCGGG	12ntR	no	B	5	-7.55	-7.94	-0.39

CCCUAAA	GCGGG	12ntR	no	B	5	-8.75	-8.76	-0.01
CCCUAAG	GUGGG	12ntR	no	B	5	-8.89	-9.04	-0.14
CCCUCAC	UAGGG	12ntR	no	B	5	-8.17	-8.43	-0.26
CCCUGAC	UAGGG	12ntR	no	B	5	-7.51	-7.88	-0.36
CGCUAAC	UAGGG	12ntR	no	B	5	-7.35	-7.78	-0.43
GCUAUG	UAUGC	11ntR	no	B	5	-7.85	-7.32	0.53
CGCUAAC	GAGCG	12ntR	no	B	5	-7.37	-7.90	-0.53
CCCUAAA	AAGGG	12ntR	no	B	5	-8.64	-9.05	-0.41
ACCUAAC	AAGGG	12ntR	no	B	5	-7.88	-8.32	-0.44
GCCUAAC	AAGGG	12ntR	no	B	5	-9.00	-9.84	-0.84
CCCUAAA	CAGGG	12ntR	no	B	5	-8.57	-8.81	-0.24
CCCUACC	CAGGG	12ntR	no	B	5	-8.35	-8.96	-0.61
CCCUUAC	CAGGG	12ntR	no	B	5	-7.90	-8.47	-0.57
UCCAAAC	GAGGA	12ntR	no	B	5	-7.63	-8.36	-0.72
CCCUUGC	GAGGG	12ntR	no	B	5	-7.50	-8.05	-0.55
CCUUAUC	GAGGG	12ntR	no	B	5	-7.32	-8.91	-1.60
CGCUAAA	GAGGG	12ntR	no	B	5	-7.46	-8.23	-0.77
CCCUAUC	GGGGG	12ntR	no	B	5	-8.72	-9.04	-0.32
CCCUAAU	GUGGG	12ntR	no	B	5	-9.21	-9.86	-0.65
CCCUCAU	GAGGG	12ntR	no	B	5	-7.47	-8.41	-0.94
CCCUACC	AAGGG	12ntR	yes	B	5	-9.34	-10.08	-0.73
CCCUUAG	GAGGG	12ntR	no	B	5	-7.29	-8.08	-0.79
CUCUCAC	GAGGG	12ntR	no	B	5	-7.50	-7.60	-0.10
CCCUUAC	GGGGG	12ntR	no	B	5	-7.87	-8.09	-0.23
CCCUAAG	AAGGG	12ntR	no	B	5	-8.73	-9.29	-0.56
CCCUAUG	GAGGG	12ntR	no	B	5	-8.13	-8.59	-0.46
UUCUAAC	GCGAA	12ntR	no	B	5	-7.21	-7.59	-0.38
CCUUAAC	GUAGG	12ntR	no	B	5	-8.42	-8.23	0.19
CCUGAG	UAAGG	11ntR	no	B	5	-7.22	-7.55	-0.33
CCCUAAC	AAAGG	12ntR	no	B	5	-7.61	-7.95	-0.34
UCCUAAC	AAGGA	12ntR	no	B	5	-9.01	-9.11	-0.10
CCCUAAC	AGGGG	12ntR	no	B	5	-8.13	-8.72	-0.59
CCCUAAC	CCGGG	12ntR	no	B	5	-8.63	-8.42	0.21
CCCUAAC	CGGGG	12ntR	no	B	5	-8.06	-8.29	-0.22
UCCCAAC	GAGGA	12ntR	no	B	5	-8.45	-9.23	-0.77
CACUCAC	GAGGG	12ntR	no	B	5	-7.16	-7.51	-0.35
CCAUAUC	GAGGG	12ntR	no	B	5	-7.54	-7.83	-0.29
CCCAAAG	GAGGG	12ntR	no	B	5	-9.08	-8.83	0.25
CCCAACC	GAGGG	12ntR	no	B	5	-9.12	-9.27	-0.15
CCCGAAU	GAGGG	12ntR	no	B	5	-9.04	-9.33	-0.29
CCCUGAC	GAGGG	12ntR	yes	B	5	-8.18	-8.18	0.00
CGCGAAC	GAGGG	12ntR	no	B	5	-8.13	-8.72	-0.59
CGCUAUC	GAGGG	12ntR	no	B	5	-7.27	-7.78	-0.51
CUCUAAU	GAGGG	12ntR	no	B	5	-7.52	-7.88	-0.36
CCCUAAC	GAGGU	12ntR	no	B	5	-7.39	-7.93	-0.54
CCCUAAU	GAUGG	12ntR	no	B	5	-8.98	-8.56	0.42
CCCCAAC	GCGGG	12ntR	no	B	5	-8.88	-8.78	0.10
CCCUAAA	GGGGG	12ntR	no	B	5	-8.26	-8.48	-0.22
UCCUAAC	GUGGA	12ntR	no	B	5	-8.84	-9.88	-1.04
CCCUAGC	UAGGG	12ntR	no	B	5	-7.48	-8.35	-0.87
CCUGAG	UCUGG	11ntR	no	B	5	-8.15	-7.55	0.60
CCCUCGC	GAGGG	12ntR	no	B	5	-8.00	-8.32	-0.31
UCCUAAC	GGGGA	12ntR	no	B	5	-7.96	-8.51	-0.55
GCCAAG	UAGGC	11ntR	no	B	5	-7.22	-7.37	-0.15
CCCUCAC	AAGGG	12ntR	no	B	5	-8.77	-8.59	0.17
CCCCAAC	CAGGG	12ntR	no	B	5	-8.01	-8.28	-0.28
CCCUUAC	GCGGG	12ntR	no	B	5	-8.75	-8.82	-0.08

CCCAAAC	UAGGG	12ntR	no	B	5	-7.64	-7.91	-0.27
CCUUAU	UAUGG	11ntR	no	B	5	-8.34	-7.76	0.57
CCCGACC	GAGGG	12ntR	yes	B	5	-9.99	-9.89	0.10
CCUUAAU	GAGGG	12ntR	no	B	5	-7.76	-8.66	-0.91
CCCAAG	UAGGG	11ntR	no	B	5	-8.02	-8.15	-0.13
CCCUAAA	GAGGG	12ntR	no	B	5	-8.35	-8.28	0.08
CCCUUAC	UAGGG	12ntR	no	B	5	-7.73	-7.98	-0.25
CCCUAGA	GAGGG	12ntR	no	B	5	-7.85	-8.61	-0.76
CCUUAAA	GAGGG	12ntR	no	B	5	-7.71	-8.72	-1.01
CCCAAAC	CAGGG	12ntR	no	B	5	-8.10	-8.20	-0.11
CCCGAAC	GCGGG	12ntR	no	B	5	-8.01	-8.52	-0.52
CCCUAAC	GGGGA	12ntR	no	B	5	-7.41	-7.36	0.05
CCCUACC	UAGGG	12ntR	no	B	5	-7.75	-8.69	-0.94
CCCUAAC	UGGGG	12ntR	no	B	5	-7.68	-7.77	-0.09
UCCUAGC	GAGGA	12ntR	no	B	5	-8.18	-8.73	-0.55
CCCUAAU	CAGGG	12ntR	no	B	5	-8.88	-9.21	-0.33
CCCUAUC	CAGGG	12ntR	no	B	5	-7.88	-8.80	-0.92
UUCUACC	GAGAA	12ntR	no	B	5	-7.41	-7.87	-0.45
CUCUAAC	GAGAG	12ntR	no	B	5	-7.20	-7.69	-0.49
GCCUAAC	GAGGC	12ntR	no	B	5	-8.59	-9.11	-0.52
CCCCAUC	GAGGG	12ntR	no	B	5	-8.67	-9.22	-0.55
CCCGGAC	GAGGG	12ntR	no	B	5	-8.23	-8.98	-0.75
CCCUAGG	GAGGG	12ntR	no	B	5	-7.82	-8.67	-0.85
CCCUAGU	GAGGG	12ntR	no	B	5	-8.14	-9.07	-0.93
CCCUCAA	GAGGG	12ntR	no	B	5	-7.30	-8.13	-0.84
CCCAAAC	GCGGG	12ntR	no	B	5	-9.61	-8.95	0.67
CCCUCAC	GGGGG	12ntR	no	B	5	-7.56	-8.02	-0.46
CCCUCAC	GUGGG	12ntR	no	B	5	-9.61	-9.29	0.32
CCUUAAC	GUGGG	12ntR	no	B	5	-7.23	-7.91	-0.68
CCCUCCC	GAGGG	12ntR	no	B	5	-9.46	-9.17	0.29
CCCUUUC	GAGGG	12ntR	no	B	5	-7.67	-8.08	-0.41
CCCUUAC	AAGGG	12ntR	no	B	5	-7.75	-8.52	-0.76
CCUAAG	CUUGG	11ntR	no	B	5	-7.34	-7.86	-0.52
UCCUAUC	GAGGA	12ntR	no	B	5	-8.92	-9.89	-0.96
CCCAAAU	GAGGG	12ntR	no	B	5	-8.50	-9.00	-0.50
CCCAAUC	GAGGG	12ntR	no	B	5	-7.44	-7.84	-0.40
CCCUAUC	GAGGG	12ntR	no	B	5	-9.07	-9.18	-0.11
CCCUCUC	GAGGG	12ntR	no	B	5	-8.70	-8.79	-0.08
CCCUGUC	GAGGG	12ntR	no	B	5	-8.00	-8.22	-0.22
CCCUUAA	GAGGG	12ntR	no	B	5	-7.49	-8.14	-0.65
CCCUAGC	GCGGG	12ntR	no	B	5	-8.72	-9.25	-0.53
CCCCAAC	GGGGG	12ntR	no	B	5	-7.81	-8.41	-0.61
CCCUAAG	UAGGG	12ntR	yes	B	5	-8.82	-9.01	-0.19
CACUAAC	GAAGG	12ntR	no	B	5	-7.30	-7.34	-0.04
GCCUACC	GAGGG	12ntR	no	B	5	-8.71	-9.49	-0.79
CCCUAAC	GCGGU	12ntR	no	B	5	-7.27	-7.84	-0.57
CCCAAAC	GAGGG	12ntR	no	B	5	-8.23	-8.26	-0.02
CCCUGCC	GAGGG	12ntR	no	B	5	-7.91	-8.12	-0.21
CCCAAAC	AAGGG	12ntR	no	B	5	-8.33	-8.46	-0.13
CCCCAAC	AAGGG	12ntR	no	B	5	-8.59	-8.65	-0.06
CCCUAUU	GAGGG	12ntR	no	B	5	-8.14	-8.95	-0.81
UCCUAAU	GAGGG	12ntR	no	B	5	-8.22	-8.49	-0.27
CCCUAAU	AAGGG	12ntR	no	B	5	-9.46	-9.57	-0.11
CCCUAUA	GAGGG	12ntR	no	B	5	-7.90	-8.58	-0.68
CCCUUCC	GAGGG	12ntR	no	B	5	-8.45	-8.46	-0.02
UCCUAUC	GAGGG	12ntR	no	B	5	-8.44	-8.80	-0.36
CCCUAAC	ACGGG	12ntR	no	B	5	-9.39	-8.89	0.50

CCCUAAU	GCGGG	12ntR	no	B	5	-9.70	-9.58	0.12
CCACAAC	GAGGG	12ntR	no	B	5	-7.59	-8.04	-0.44
CCAUAAC	GAUGG	12ntR	no	B	5	-7.70	-7.99	-0.29
CCCCAAA	GAGGG	12ntR	no	B	5	-8.85	-8.87	-0.02
CCCUCAC	GAGGG	12ntR	no	B	5	-8.50	-8.56	-0.05
CCCUAGC	AAGGG	12ntR	no	B	5	-8.64	-9.32	-0.68
CCCUAAA	UAGGG	12ntR	no	B	5	-8.93	-9.14	-0.21
CCCAAAC	GUGGG	12ntR	no	B	5	-9.22	-9.48	-0.26
CCCCACC	GAGGG	12ntR	no	B	5	-9.33	-9.99	-0.66
CCCUAAC	GGGGG	12ntR	no	B	5	-8.11	-8.15	-0.04
CCCUAAC	GUGGG	12ntR	no	B	5	-9.49	-8.82	0.66
CCCUAAC	AUGGG	12ntR	no	B	5	-8.99	-8.91	0.09
CCCUUAC	GAGGG	12ntR	no	B	5	-8.47	-8.26	0.21
CCCUAUC	UAGGG	12ntR	no	B	5	-7.36	-8.01	-0.65
CCCUAAC	UCGGG	12ntR	no	B	5	-9.00	-8.65	0.35
CCCUGAC	GUGGG	12ntR	no	B	5	-7.96	-8.28	-0.32
CCCUACA	GAGGG	12ntR	no	B	5	-8.15	-8.46	-0.31
GCCUGAC	GAGGG	12ntR	no	B	5	-8.07	-8.55	-0.48
CCCUAUC	GUGGG	12ntR	no	B	5	-8.20	-8.61	-0.41
CCCUACC	GGGGG	12ntR	no	B	5	-8.90	-10.05	-1.15
CCCUUAU	GAGGG	12ntR	no	B	5	-7.57	-8.74	-1.17
CCCUAUC	AAGGG	12ntR	no	B	5	-8.96	-9.42	-0.46
UCCUACC	GAGGA	12ntR	no	B	5	-8.86	-8.99	-0.13
CCCCAAC	GAGGG	12ntR	no	B	5	-8.33	-8.54	-0.21
CCCUAAC	UUGGG	12ntR	no	B	5	-7.94	-8.50	-0.56
CCCUAAC	UAGGG	12ntR	no	B	5	-7.86	-8.26	-0.40
CCCUAAA	GUGGG	12ntR	no	B	5	-7.94	-8.58	-0.64
UCCUAAC	GAGGA	12ntR	yes	B	5	-8.41	-8.61	-0.20
CCUGCG	CACGG	11ntR	no	B	5	-8.13	-8.91	-0.77
CCCGAUC	GAGGG	12ntR	no	B	5	-9.30	-9.59	-0.29
CCCCAAC	GUGGG	12ntR	no	B	5	-9.19	-9.27	-0.07
CCCCAAU	GAGGG	12ntR	no	B	5	-9.35	-9.30	0.05
CCCAAAA	GAGGG	12ntR	no	B	5	-8.59	-8.55	0.04
CCCUACG	GAGGG	12ntR	no	B	5	-8.40	-8.75	-0.34
CCCUAAG	CAGGG	12ntR	no	B	5	-9.60	-9.63	-0.04
CCCUACU	GAGGG	12ntR	no	B	5	-8.65	-9.15	-0.50
CCCUGAC	AAGGG	12ntR	no	B	5	-8.33	-8.55	-0.22
CCCUAGC	GAGGG	12ntR	no	B	5	-7.78	-8.26	-0.48
CCCGAAC	GAGGG	12ntR	no	B	5	-9.02	-8.93	0.09

Table S4. Sequences of DNA and RNA oligos used. RNA nucleotides are preceded by an 'r'.

Name	Sequence
Oligopool_left	TTGTATGGAAGACGTTCCTGGAT
Oligopool_right	GCTGAACCGCTCTTCCGATCT
Short_C	AATGATACGGCGACCACCGA
Short_D	CAAGCAGAAGACGGCATACGA
C1_R1_BC_RNAP	AATGATACGGCGACCACCGAGATCTACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNNNNNNNNT TTATGCTATAATTATTTCATGTAGTAAGGAGGTTGTATGGAAGACGTTCCTGGAT
D_Read2	CAAGCAGAAGACGGCATACGAGATCGGTCTCGGCATTCCTGCTGAACCGCTCTTCCGATCT
Fluorescent_stall	GGATCCAGGAACGTCTTCCATACAACCTCCTTACTACAT-3'Alexa647(NHSester)
Biotin_D_Read2	5'Biotin-CAAGCAGAAGACGGCATACGAGATCGGTCTCGGCATTCCTGCTGAACCGCTCTTCCGATCT
Dark_stall	GGATCCAGGAACGTCTTCCATACAACCTCCTTACTACAT
Dark_read2	CGGTCTCGGCATTCCTGCTGAACCGCTCTTCCGATCT
Mut2_GAAA	5'-amino-C6 rCrUrArGrGrArArUrCrUrGrGrCrCrCrArUrAr GrArArGrGrArArArCrUrUrCrUrArUrGrGrGrC rCrUrGrUrGrUrCrCrUrArG
Mut2_GUAA	5'-amino-C6 rCrUrArGrGrArArUrCrUrGrGrCrCrCrArUrAr GrArArGrGrUrArArCrUrUrCrUrArUrGrGrGrC rCrUrGrUrGrUrCrCrUrArG

Supplementary Dataset. Spreadsheet contains all binding measurements presented in this study. First sheet ("Key") provides definitions. Second sheet ("Classified TLRs") provides binding constants across different scaffolds and average affinities for TLR sequences that formed stable TL/TLRs, defined as those with average affinities < –7.1 kcal/mol. Values > –7.1 kcal/mol are lower limits. Third sheet ("Weak TLRs") lists sequence of TLRs that forms weak TL/TLRs with average affinities > –7.1 kcal/mol. Fourth sheet ('Scaffold sequences') provides sequence of scaffolds with canonical 11ntR_{wt} inserted.

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