SUPPORTING INFORMATION

The fifth domain in the G-quadruplex-forming sequence of the human *NEIL3* promoter locks DNA folding in response to oxidative damage

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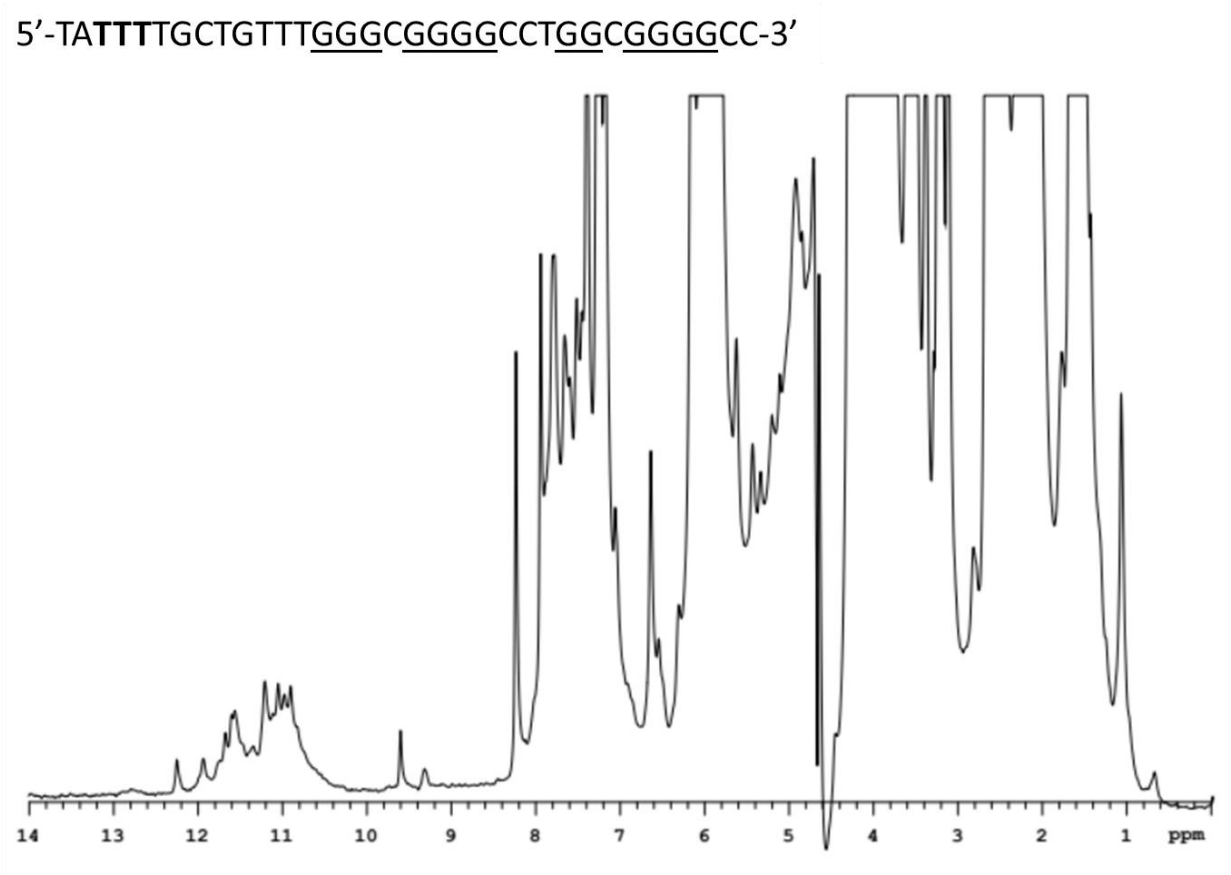

Figure S1. The ^{1}H-NMR spectra of *NEIL3* G4 sequence with a modified 5th G-run.

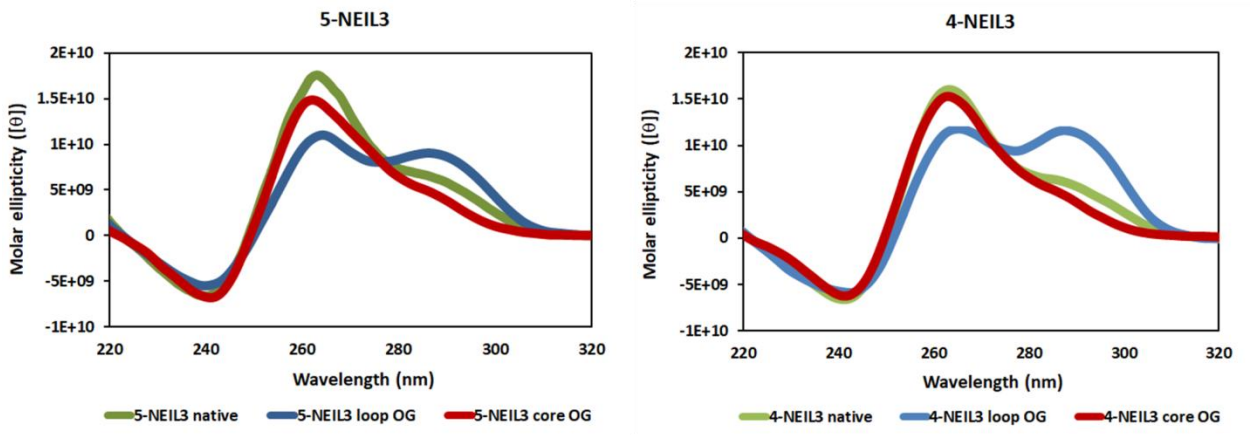

Figure S2. CD spectra of the 5- and 4-track *NEIL3* G4 sequences with and without OG. Experimental conditions: CD measurements were collected at 25 °C using a 1.0-mm quartz cuvette containing G4 sample (20 μM) in 20 mM cacodylic acid (pH 7.4) with 140 mM KCl and 12 mM NaCl. Plots of molar ellipticity were generated by normalizing the background subtracted data.

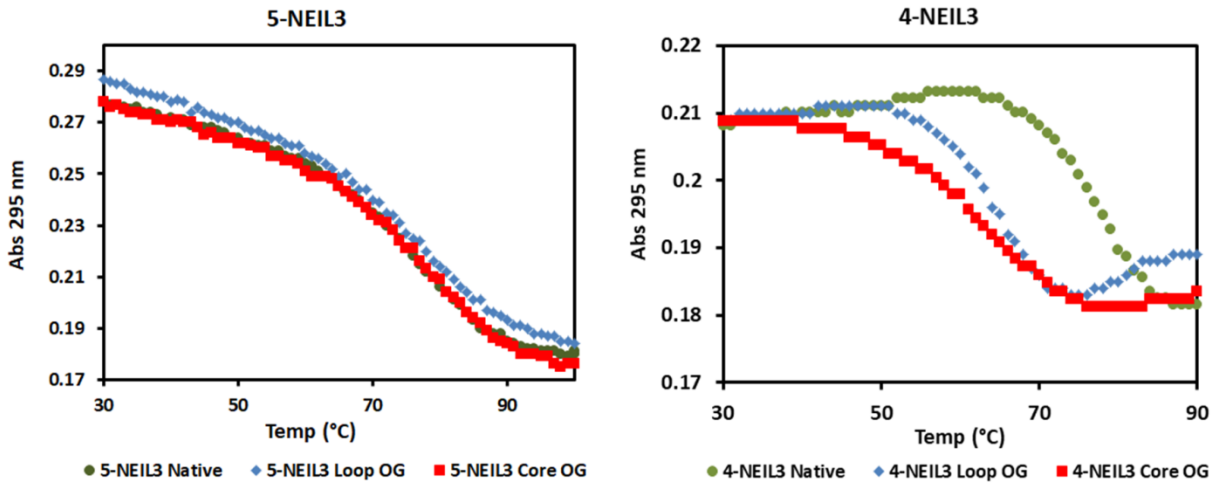

Figure S3. T_m curves of 5- and 4-track *NEIL3* G4 sequences with and without OG. Experimental conditions: DNA sample (5 μM) was annealed in 20 mM cacodylic acid (pH 7.4) with 140 mM KCl and 12 mM NaCl. Thermal melting analysis was initiated by equilibrating the G4 sample at 20 °C for 3 min before being heated to 100 °C then cooled back down to 20 °C at a rate of 1 °C/min. Absorbance readings at 295 nm were measured in triplicate samples.

A

5'-TAGGGTGCTGTTTGGGCGGGGCCTGGGCGGGGCC-3' 5-NEIL3 native

5'-TAGGGTGCTGTTTGGGCGGGGCCT**GGG**CGGGGCC-3' 5-NEIL3 core OG

5'-TAGGGTGCTGTTTGGGCGGGGCCT**TGG**CGGGGCC-3' 5-NEIL3 TGG

5'-TAGGGTGCTGTTTGGGCGGGGCCT**TTG**CGGGGCC-3' 5-NEIL3 TTG

5'-TAGGGTGCTGTTTGGGCGGGGCCT**TTT**CGGGGCC-3' 5-NEIL3 T-run

B

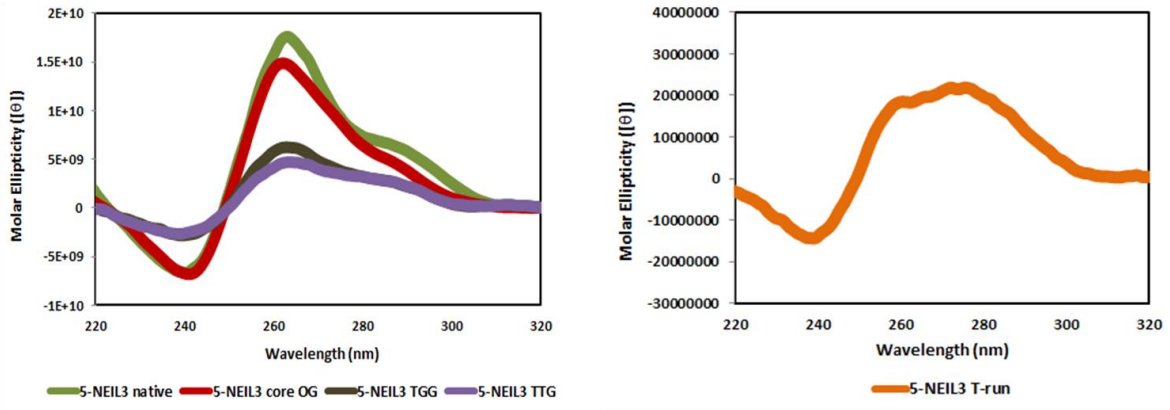

Figure S4. (A) The primary sequences of the native and modified 5-track *NEIL3* G4 sequences. (B) The CD spectra of the sequences shown in (A). Experimental conditions: CD measurements were collected at 25 °C using a 1.0-mm quartz cuvette containing G4 sample (20 μM) in 20 mM cacodylic acid (pH 7.4) with 140 mM KCl and 12 mM NaCl. Plots of molar ellipticity were generated by normalizing the background subtracted data.

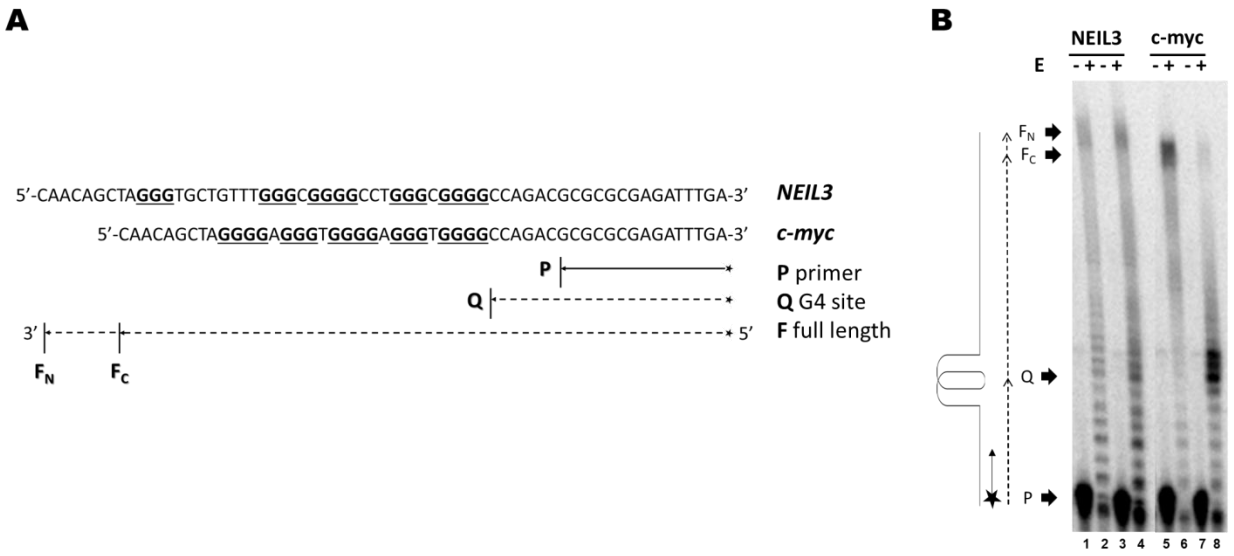

Figure S5. (A) The native *NEIL3* G4 sequence and a modified sequence that carries the *c-MYC* G4 instead. Gel bands that correspond to the expected G4 site Q, full length extension products for *NEIL3* $F_{N,}$ and *c-MYC* F_C are indicated. (B) Autoradiograph of the DNA polymerase stop assay using the sequences in (A). Primer annealed-template DNA P were incubated at 37 °C for 30 min with (+) or without (-) the Klenow Fragment enzyme E. Even-numbered lanes in were reacted in buffered solution containing 10 mM KCl, 12 mM NaCl and 5 mM $MgCl_2$, while the odd-numbered lanes are control experiments that were reacted in buffered solution containing 152 mM LiCl and 5 mM $MgCl_2$.

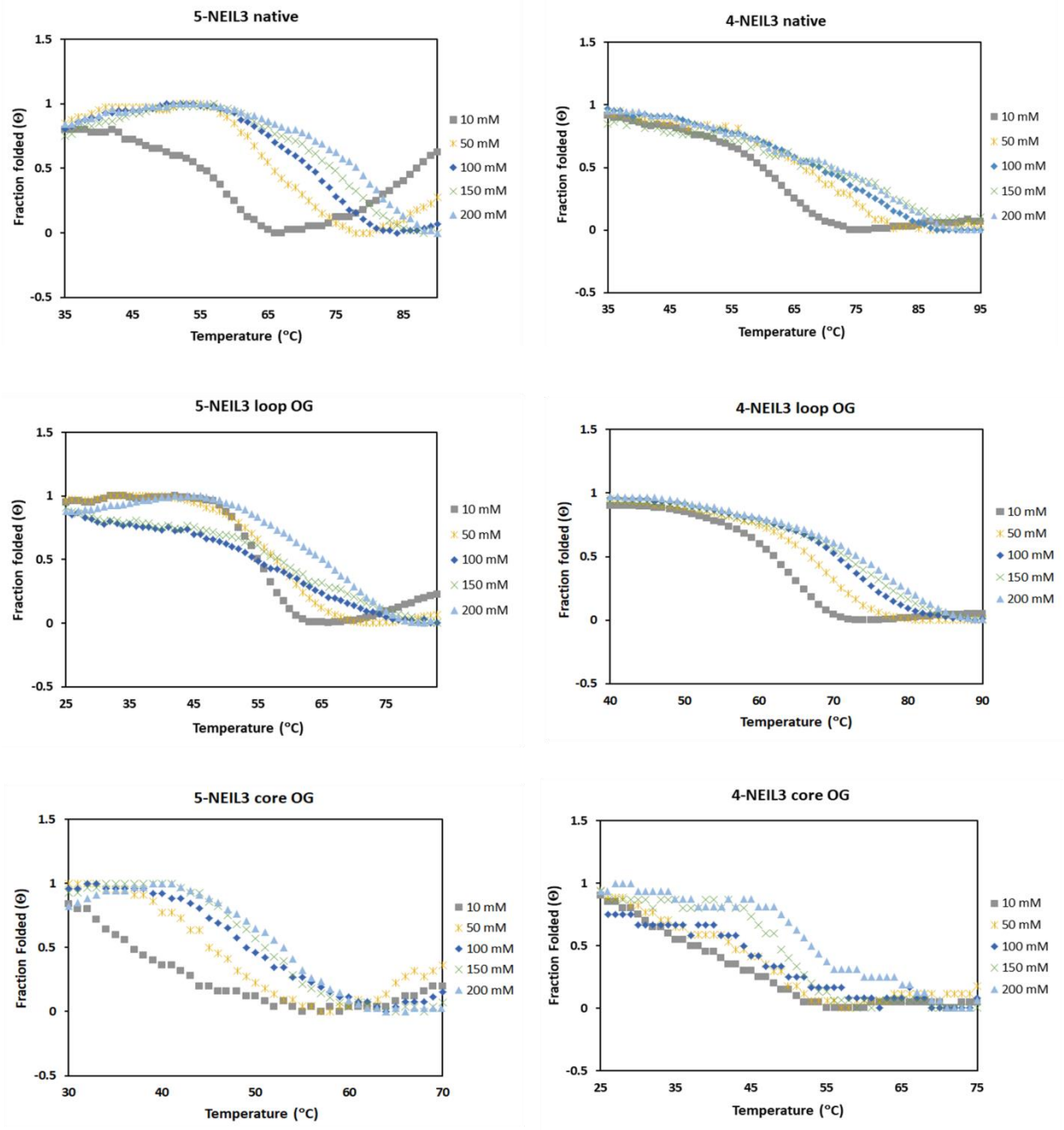

Figure S6. T_m curves of 5- and 4-track *NEIL3* G4s with and without OG in different K^+ ion concentration. Experimental conditions: DNA sample (5 μM) was annealed in the presence of varying K^+ concentration (10-200 mM) in potassium phosphate buffer (pH 7). Thermal melting analysis was initiated by equilibrating the G4 sample at 20 °C for 3 min before being heated to 100 °C then cooled back down to 20 °C at a rate of 1 °C/min. Absorbance readings at 295 nm were measured in triplicate samples.

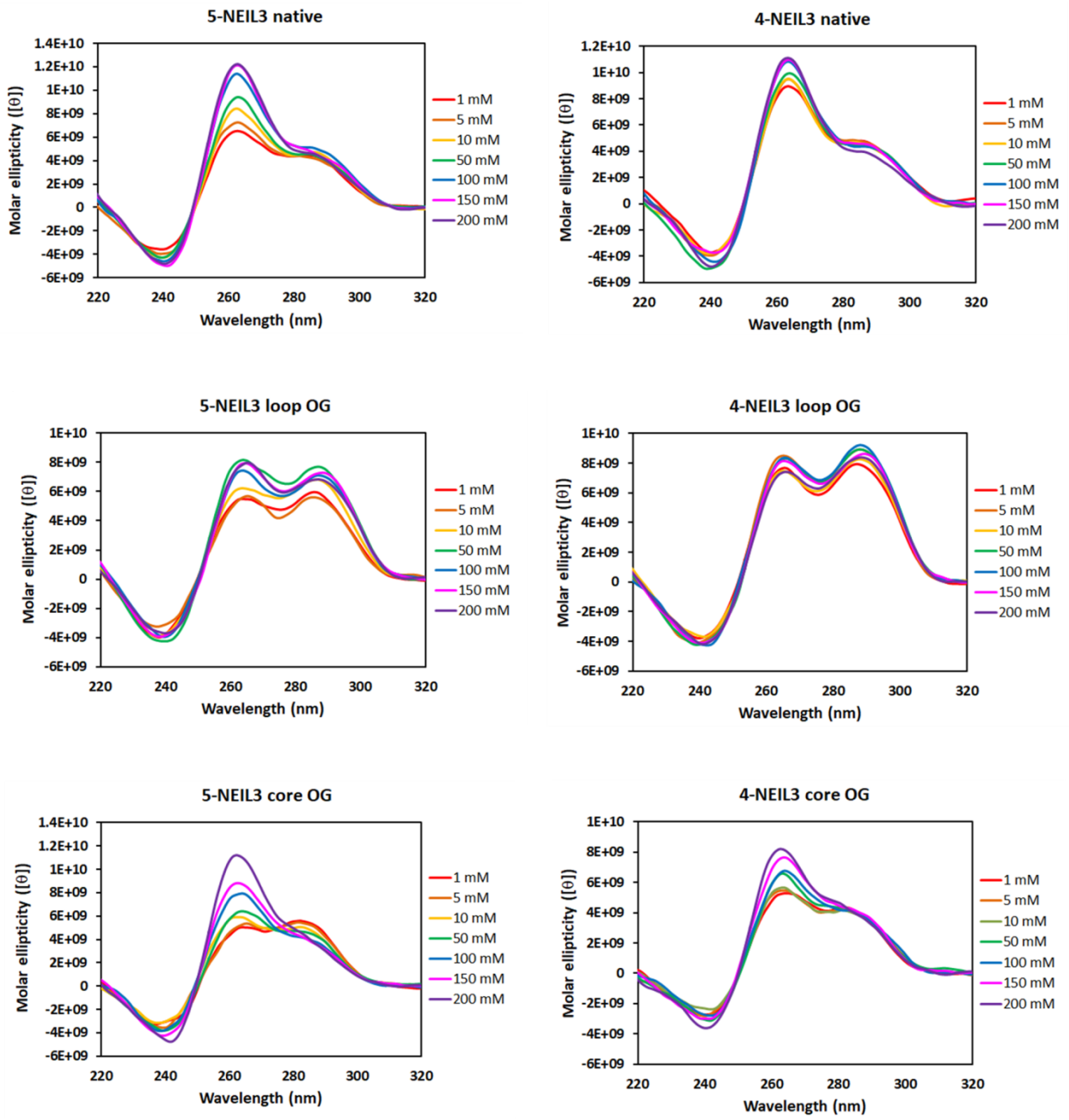

Figure S7. CD spectra of the 5- and 4-track *NEIL3* G4 sequences with and without OG in different K^+ ion concentration. Experimental conditions: CD measurements were collected at 25 °C using a 1.0-mm quartz cuvette containing the G4 sample (20 μM) in 20 mM cacodylic acid (pH 7.4) with different K^+ concentration (1-200 mM). Plots of molar ellipticity were generated by normalizing the background subtracted data.

Table S1. Thermodynamic profiles of *NEIL3* G4 sequences.

NEIL3 G4 Sequence	T_m (°C)	ΔG, 37°C (kcal/mol)	ΔH (kcal/mol)	ΔS (cal/mol*K)	ΔnK^+
5-NEIL3 native	75.6 ± 1.1	-4.6 ± 0.1	-43.0 ± 0.9	-123.8 ± 2.5	1.3
5-NEIL3 loop OG	78.1 ± 1.1	-5.2 ± 0.5	-63.2 ± 2.1	-187.0 ± 6.2	1.4
5-NEIL3 core OG	76.3 ± 0.8	-3.0 ± 0.4	-67.2 ± 8.3	-207.2 ± 25.2	1.3
4-NEIL3 native	77.5 ± 1.0	-2.3 ± 0.1	-22.8 ± 0.9	-66.0 ± 2.6	0.5
4-NEIL3 loop OG	65.9 ± 0.9	-3.8 ± 0.1	-38.7 ± 1.1	-112.5 ± 3.1	0.6
4-NEIL3 core OG	65.5 ± 0.9	-2.4 ± 0.2	-67.3 ± 7.9	-209.4 ± 24.7	0.5