A folding motif formed with an expanded genetic alphabet

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This study explores how adding synthetic nucleotides to DNA not only increases its information density but also diversifies its three-dimensional structures. Specifically, the research introduces an additional nucleotide (dZ) to a DNA strand, forming a stable unimolecular structure called the folded Z-motif (fZ-motif). fZ potentially expands DNA technology applications in catalysis and information storage due to its compact and unique form.

Researchers used several analytical methods, including NMR spectroscopy, to characterize the fZ-motif. DNA strands containing the dZ nucleotide exhibit a stable and unique structure over a pH range of 8-9 with six reverse, skinny dZ:dZ$^-$ base pairs. Their experiments highlight how the NMR capabilities of the MagLab can determine the unique structural properties of the fZ-motif and characterize the temperature and pH conditions over which it is stable.

The discovery of the fZ-motif advances the field of synthetic biology by demonstrating a new type of DNA folding enabled by an expanded genetic alphabet. This finding opens the door to potential applications in nanotechnology and molecular biology, including the development of new DNA-based sensors and nanomachines that respond to environmental changes.

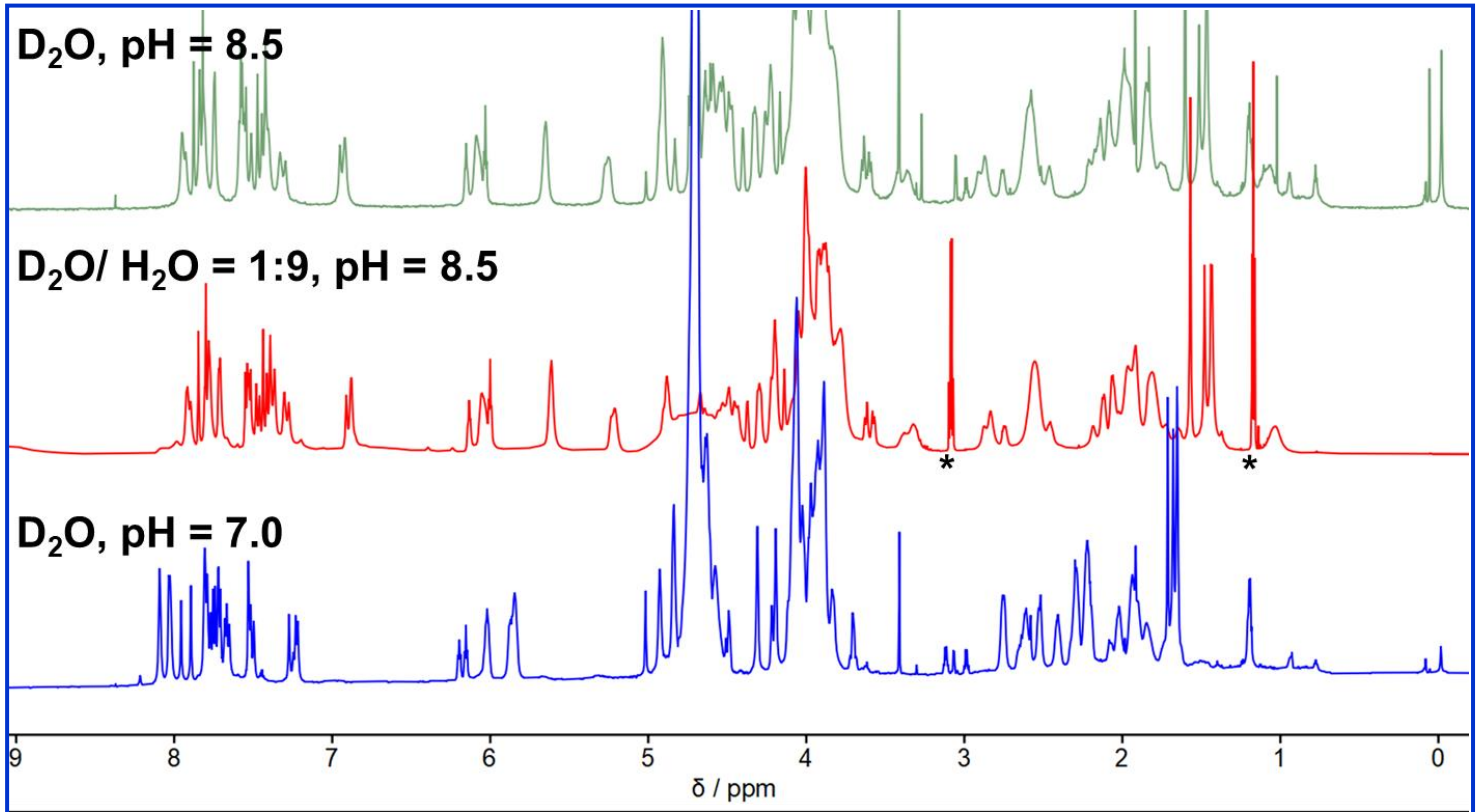

Figure 1: *Characterization of the fZ-motif formed by DNA containing dZ using ^{1}H NMR spectroscopy. A 2 mM solution of the ZZZ oligonucleotide was examined by NMR at 18.8T using aqueous buffers with varying pH and ^{1}H / ^{2}H isotope ratios to characterize hydrogen exchange, a reporter on the stability of different hydrogen bonding patterns in DNA.*

Facilities and instrumentation used: AMRIS Facility NMR Spectrometers at 600 MHz and 800 MHz (14.1 and 18.8T).

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