

RIGID SMALL MOLECULE-DNA HYBRID (rSMDH) AGGREGATE FORMATION

Brian R. Stepp, Julianne M. Gibbs-Davis, Dorothea L. F. Koh, SonBinh T. Nguyen

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In this NU-NSEC research, rigid small molecule-DNA hybrids (rSMDHs) were synthesized and used to evaluate how the number of cooperative duplexes and their orientation affects the melting transition of DNA hybrid materials. Based on the Schatz-Mirkin shared ion-cloud theoretical model, as few as two or three parallel cooperatively bound DNA duplexes would exhibit enhanced melting properties. In reality, it is difficult to approach this lower limit with current DNA hybrids. However, these researchers demonstrated that when “caged” dimers possessing exactly *three* parallel duplexes are formed from dilute rSMDH solutions they melt at higher temperatures and with much sharper features than the corresponding unmodified DNA sequence due to substantial ion-cloud overlap between the component duplexes. The NU-NSEC research team also found that concentrated solutions of randomly hybridized rSMDHs, which do not allow for ion-cloud overlap, melt in a similar fashion as unmodified DNA duplexes. This important work provides conclusive evidence to support the shared ion-cloud model as a critical tool for understanding DNA (de)hybridization in DNA detection strategies. It also allows researchers to push the limits in the design of next-generation DNA-based materials to greatly enhance the natural recognition ability of DNAs via precisely spaced and finely tuned duplex interactions.

