

Sequence-dependent structural differences in RNA•DNA hybrids

Danyal Floisand and Tricia D. Shepherd
Westminster College, Salt Lake City, UT 84105

Molecular dynamics is used to study the structure and flexibility of RNA•DNA hybrids in aqueous solution. RNA•DNA hybrid duplexes are biologically important molecules with potential therapeutic properties. While it is known that the hybrids are stabilized when purine bases are present in the RNA strand, both experimental and theoretical studies present conflicting results regarding the flexibility of the hybrid duplexes compared to the homoduplex structures. In order to further investigate the flexibility and sequence-dependent structural effects, we performed molecular dynamics simulations using AMBER 9 on a series of RNA•DNA duplexes systems for which the purine base content of the RNA strand was systematically increased from containing only pyrimidine to only purine bases. Dihedral angle and sugar pucker analysis show that the pyrimidine rich DNA strands exhibits both A-/B-like structural properties, while the pyrimidine-rich RNA strands retain their A-type properties.

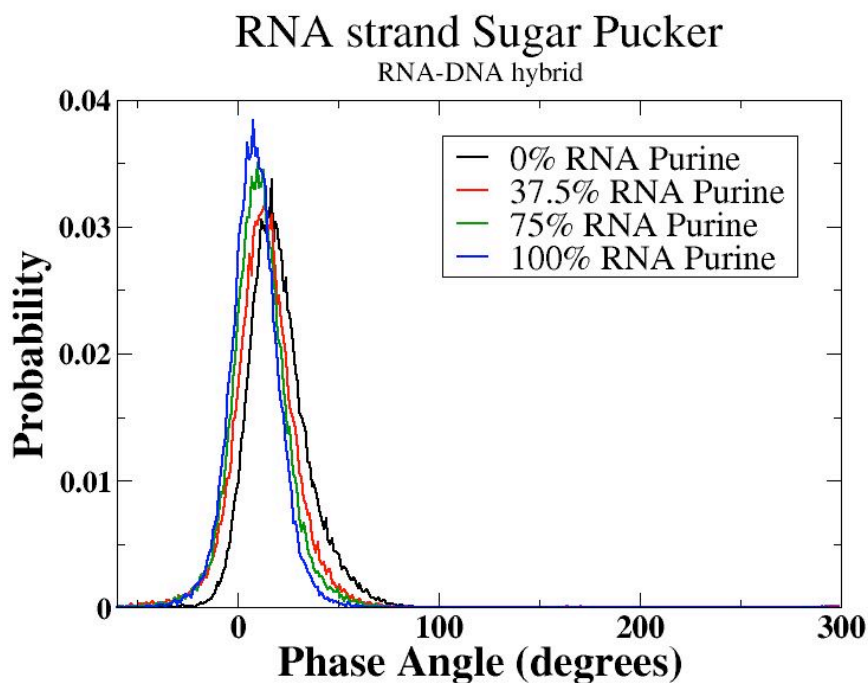


Figure 1: Probability distributions of the sugar pucker pseudorotation phase for the RNA strand in four different RNA•DNA hybrid duplexes. While the number (and identity) of the purine bases was the same for each 8-mer duplex, the number of purines attached to the RNA strand varied from 0 to 8 bases.