

4.1.10 HOW LONG IS A PIECE OF DNA?

F. D. Lewis, L. Zhang, X. Liu, X. Zuo, D. M. Tiede, H. Long, G. C. Schatz, "DNA as Helical Ruler: Exciton-Coupled Circular Dichroism in DNA Conjugates," *J. Am. Chem. Soc.*, **2005**, *127*, 1444–1453.

DNA is the fundamental repository of genetic information. Its molecular structure is well-known from x-ray crystallography, but such measurements refer to DNA in the crystalline form, not in solution or in living systems. Information about the structure of DNA in these environments has been difficult to obtain, but a recent experiment/theory collaboration between NU-NSEC researchers has provided for the first time important information about solution structure.

In these experiments the DNA is "capped" by stilbene molecules, leading to a hairpin structure. The structural information involves UV-vis spectroscopic measurements using a technique known as exciton-coupled circular-dichroism in combination with theoretical modeling of the DNA structure and spectra. This leads to a determination of the helical twist angle between the capping stilbenes. By varying the length of the DNA, it is possible to determine twist as a function of length.

The results generated to date are in excellent agreement with Watson-Crick structures. However, the modeling shows that the molecules are in constant motion, with the Watson-Crick structures being correct only on average.

