Formation of functionalizable DNA sheets via phenanthrene sticky ends

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In nanotechnology DNA is used to create one-, two-, or three-dimensional assemblies due to its unique molecular recognition properties which opens opportunities to precisely organize materials within those structures.[1] Combining DNA building blocks with other molecules can influence the structure and introduce other functionalities. Such functional supramolecular polymers have potential for biomedical, biomimetic and electronic applications.[2] In this contribution we show that complementary DNA strands with each three phosphate-linked dialkynyl-phenanthrenes at their 3'-ends form duplexes with amphiphilic overhangs. In presence of spermine, those overhangs act as sticky ends which link the duplexes in two dimensions. Supramolecular two-dimensional sheets with altering DNA and phenanthrene parts are formed. Fluorescence measurements show that the assembled phenanthrene units act as light harvesting antennae and transfer absorbed energy to an acceptor which is either directly added to the polymer or added attached to a complementary DNA strand. Those DNA architectures allow constructing and investigating light harvesting antennae with acceptors at defined distances to the donors. In addition, the DNA part opens other possibilities for functionalization.

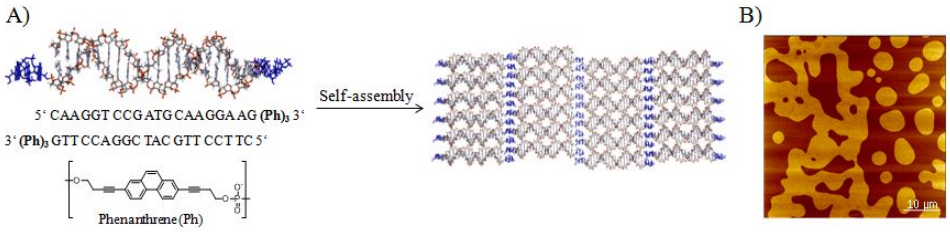

Figure 1: A) Structure and sequences of the duplex with phenanthrene overhangs and putative model of the self-assembly into two-dimensional sheets. B) AFM picture of supramolecular DNA sheets.

[1] F. A. Aldaye, A. L. Palmer, H. F. Sleiman, *Science*, **2008**, 321, 1795-1799.
[2] T. Aida, E. W. Meijer, S. I. Stupp, *Science*, **2012**, 335, 813-817.