Hierarchical self-assembly of nucleotide-appended oligopyrenotides into defined supramolecular objects

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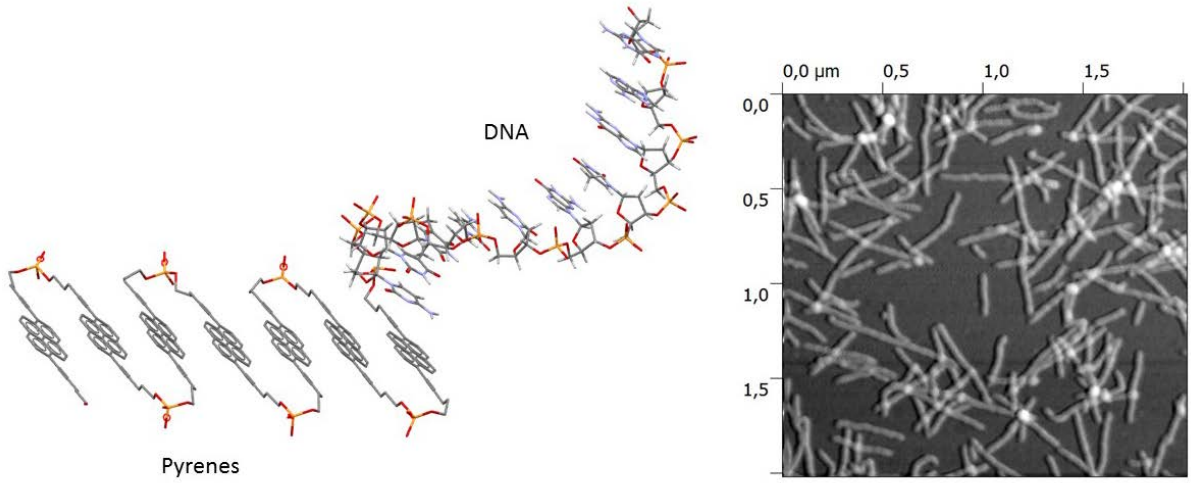
Supramolecular DNA assembly blends DNA building blocks with synthetic organic and inorganic molecules giving structural and functional advantages both to the initial self-assembly process and to the final construct.[1]

Synthetic molecules can bring a number of additional interactions into DNA nanotechnology. Incorporating extended aromatic molecules as connectors of DNA strands allows folding of these strands through π-π stacking (DNA "foldamers"). [2]

In previous work it was shown that short oligopyrenotides (phosphodiester-linked pyrene oligomers) behave as staircase-like foldamers, which cooperatively self-assemble into two-dimensional supramolecular polymers in aqueous medium. [3]

Herein, we demonstrate that a 10-mer DNA-sequence modified with 7 pyrene units (see illustration) forms dimensionally-defined supramolecular polymers under thermodynamic conditions in water. We present the self-assembly behavior, morphological studies, and the spectroscopic properties of the investigated DNA-sequences (illustrative AFM picture shown below).



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