Synthesis and assembly of DNA-templated chromophore aggregates for light harvesting

Introduction and previous results

The hierarchical organization of dyes at the supramolecular level can be achieved if synthetic building blocks self-assemble with well-defined molecular geometries and chromophore distances. The regular geometry of DNA namely the double helical structure and the typical stacking distance of ≈ 3.4 Å between the bases offer a suitable structural scaffold. Our group has shown that the chromophores ethynyl pyrene and ethynyl nile red as conjugates with nucleosides self-assemble non-covalently and specifically along DNA templates. The mixed assemblies of both chromophores are highly ordered, show left-handed chirality and yield dual fluorescence.[1,2] On the other hand, molecular switches provide an important tool and handle to trigger the DNA-based architectures and thereby their optical properties by light.[3-6]

Goals

In this project we plan to develop DNA-based architectures for non-covalent arrangement of of chromophores and molecular switches, both attached to nucleosides as hydrogen-binding building blocks. Statistical mixture of chromophores and molecular switches should aggregate spontaneously along a single-stranded oligonucleotide that serves as template. In the ideal case the use of molecular switches influence the chromophore arrangement in such a way that either the chiral chromophore stack is spontaneously built or completely inhibited. Thereby the optoelectronic properties of the chromophore stacks can be switched by light.

References

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