Increasing the Energy Transfer Efficiency of DNA-Photonic Wires with Light-Harvesting Supramolecular Polymers

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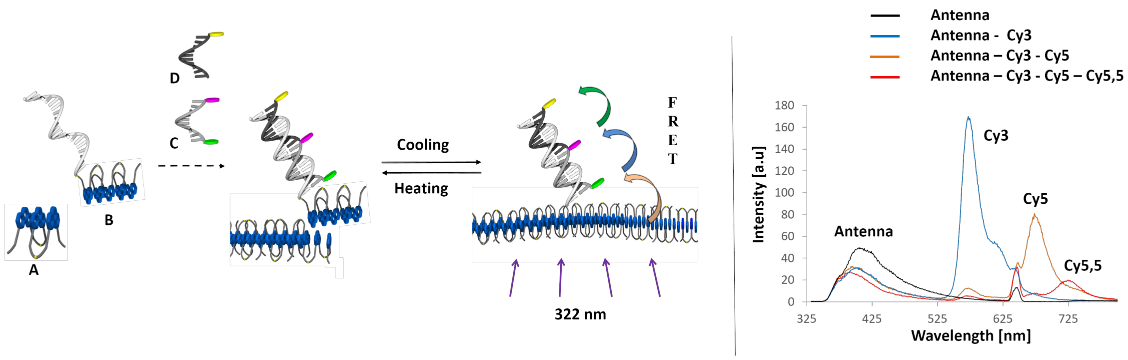
Design of artificial light-harvesting platforms functionalized with DNA-grafted photonic wires is under great interests for designing new nanomaterials and nanodevices [1]. However there are very few DNA-bioinspired materials for the construction of multi-step FRET cascades simultaneously attached to functional light-harvesting platform. In natural light-harvesting systems the energy is absorbed by an assembly of molecules and transferred via Förster resonance energy transfer (FRET) to reaction centres where the absorption is amplified [2]. Scaffolding DNA properties as well as control over fluorophore positioning allows the creation of artificial photonic wire. Herein we demonstrate integration of such DNA-based photonic structures with supramolecular polymers for extending light-harvesting and enhancing directional FRET properties. We have recently reported supramolecular polymers (SPs) consisting of a phosphodiester-linked phenanthrene core as linear individual fibers or nanotubes [3,4]. Presented here SPs-DNA-grafted photonic wires with arranged up to 3 fluorophores along the DNA scaffold is a next step in increasing efficiency of FRET process upon phenanthrene excitation with broad potential in nanotechnology.

Assembly of phenanthrene oligomer **A** doped with 1.8 mol% of oligomer **B** composed of DNA strand (20 nucleotides) and 5`-end attached phenanthrene units yields in supramolecular light-harvesting platform upon heating-cooling process. SPs - photonic wire polymer is assemble via hybridization of DNA fragments labeled with a series of donor-acceptor cyanine dyes (**C**, **D**). Our spectroscopic studies clearly show that each addition of increasingly red-shifted dye significantly induces the consecutive quenching of the fluorescence of the previous donor-acceptor dye (Cy3, Cy5). Energy Transfer Efficiency is investigated by programing series of photonic wire configurations.



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