DNA as a supramolecular scaffold for porphyrin and metal complex assemblies

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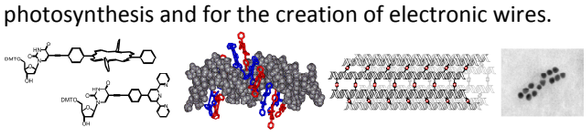
DNA has become very attractive as scaffold for functional molecules on the nanometre scale. The sequence specific insertion of modified nucleotides using automated DNA synthesis allows for the creation of new designer molecules with a wide range of potential applications. We have established a general synthetic route to porphyrin-nucleosides and their subsequent site specific incorporation into oligonucleotides to create multiporphyrin arrays. Up to eleven consecutive porphyrins could be incorporated into DNA giving access to a multiporphyrin array of approximately 10 nm in length, which corresponds to the highest amount of DNA modification with a large hydrophobic metal complex.[1] The spectroscopic data and structure calculations indicate the formation of a stable helical array in the single strand porphyrin-DNA. The π-stack of the porphyrins leads to strong electronic interaction between the chromophores. The stability and spectroscopic features of the porphyrin arrays will be discussed. A new zipper array with induced stability and energy transfer properties has recently been realised, providing access to the first reversible photonic wire based on a DNA scaffold.[2] We have expanded our system to terpy-containing nucleotides which can form supramolecular structures through metal complexation and branching.[3] New systems for the creation of porphyrin arrays will be presented, together with DNA-templated assembly of wires from nanoparticles. Also, the stabilisation of G-quadruplex structures with covalently linked porphyrins will be discussed. The DNA based supramolecular assemblies are very promising for applications in photodynamic therapy, artificial photosynthesis and for the creation of electronic wires.



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