Self-organized DNA nanostructures based on oligodeoxyribonucleotides and its derivatives

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Self-assembled DNA nanostructures are very promising tools for the drug delivery and biomarker detection. The efficient usages of these multicomponent associates are reliable in case of development of fundamental chemical and physico-chemical basis for characterizing polymeric DNA complexes. DNA concatemers formed by native, bended or branched [1,2] oligonucleotides were characterized via the gel electrophoresis and atomic force microscopy (AFM) in air by tapping mode. Atomic force microscopy (AFM) is very useful tool for direct visualization of double stranded DNA structures. We have optimized the protocols of visualization of supramolecular DNA complexes on mica surface via the AFM technique. It was shown that the preliminary processing of mica surface is necessarily. It was established that the processing of APTES to the layer of newly air-cleaved mica surface and addition of Ni (II) cations minimize the DNA structure perturbation. Using optimized visualization protocol the influence of oligonucleotides structure on spatial organization of supramolecular DNA associates was studied. It was shown that the presence of non-nucleotide insert in the oligonucleotide chain lead to bending dsDNA and formation of self-limited DNA concatemers. In contrast, branched oligonucleotides could form a branched filaments and a dense DNA network (see fig. 1).

Using the AFM technique as a direct method of nanostructure visualization we have demonstrated the possibility of manufacturing and self-organization of DNA multicomponent complexes with predefined topology and thermal stability. These DNA associates are formed from rationally designed oligonucleotides and their derivatives.

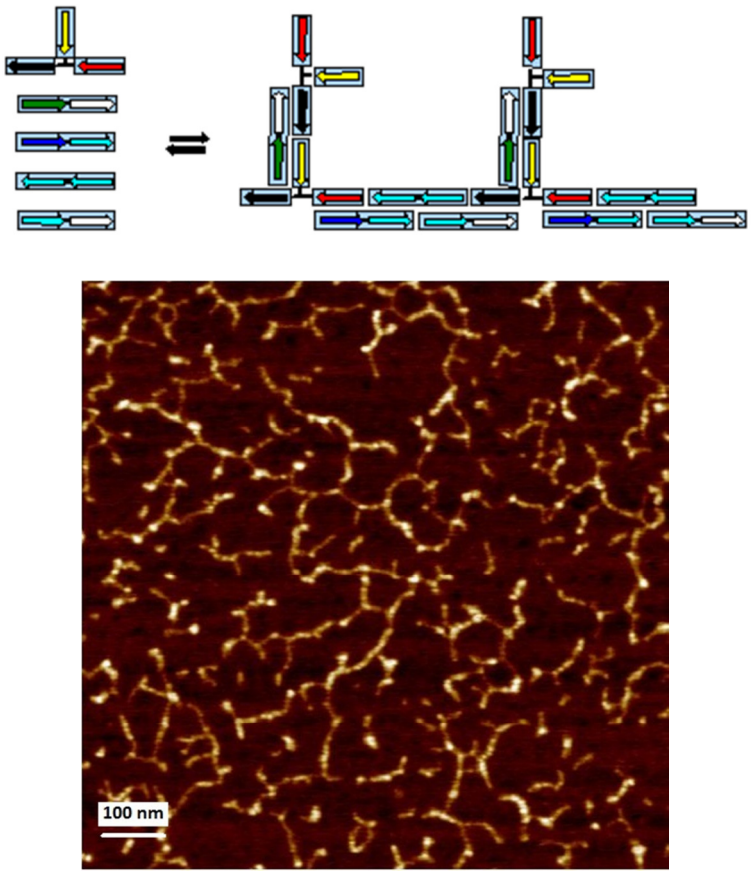

Fig. 1. AFM image of branched DNA concatamers constructed from 5 different oligonucleotides (length 30 – 45 b.p). $C_{total} = 5*10^{-7}$M, buffer: 2mM Tris HCl, 10 mM $MgCl_2$, pH 8.0.

References.

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