Single molecule fluorescence investigations of DNA-based self-assembled structures

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DNA can fold into a number of secondary structures that play a role in the regulation of gene expression [1]. It can also be harnessed as a building block in the field of DNA nanotechnology to create both static and dynamic DNA structures of all shapes with sizes ranging from a few to several hundreds of nanometers [2]. Owing to their phenomenal addressability, these DNA nanostructures are attractive platforms for organizing matter at the molecular level and provide high flexibility for positioning fluorescent molecules.

To obtain insights into structural dynamics of natural and artificial DNA structures, we used single molecule fluorescence microscopy. The method allows resolving the different conformations of these structurally heterogeneous systems and studying the properties of fluorescent molecules arranged onto DNA templates. I will present our single molecule fluorescence data analysis platform [3] and investigations of the structural heterogeneity and dynamics of different DNA structures [4,5] and of fluorescent DNA modified conjugated polymers [6,7]. Our results give insights into DNA folding and local structure as well as guidelines to achieve nanoscale spatial control of fluorescent molecules.

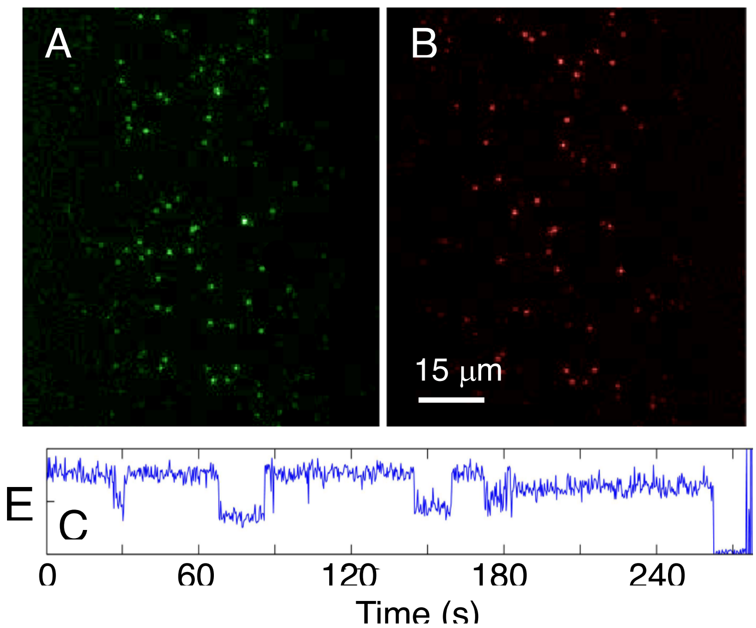

Figure 1. A) and B) CCD images of surface-immobilized DNA G-quadruplex structures labelled with two different fluorophores, each imaged in its color channel shown in green and red, respectively. Each spot shows fluorescence from individual DNA molecules. C) Förster resonance energy transfer (FRET) efficiency between the two fluorophores as a function of time. The time trace shows conformational changes of a single DNA molecule.

References.

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