Structure and dynamics of DNA confined between non-cationic lipid membranes

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We have investigated the structural and diffusive properties of DNA confined in the lamellar phase of neutral lipid. Using a special chamber for humidity control, **we obtained oriented samples** with supported films. This geometry allows the accurate description of the DNA's orientation with respect to the lipid bilayer.

We have performed x-ray studies of different systems with various amount of water in order to understand the effect of the confinement on the DNA's organisation. We observe different phase transitions from an isotropic to a nematic-type DNA organisation (in diluted systems) to a rectangular columnar DNA lattice (in concentrated systems) between the neutral bilayers of a 3D smectic phase. We obtained for the first time a hexagonal DNA organisation in a neutral lamellar phase (without any change of the membrane fluidity). This new phase has been found in a very concentrated system, i.e. with a small amount of water.

In order to correlate the structural and diffusive properties of the system, we started "surgical" FRAP experiments, using a confocal microscope (CLSM) on oriented samples. We have identified three modes of DNA diffusion: an isotropic diffusion, a noncorrelated nematic anisotropic diffusion, and finally a correlated nematic anisotropic diffusion with correlation between neighbouring layers. Further we present a method of data analysis that allows to distinguish between isotropic and anisotropic diffusion, when averaging over several layers of a lamellar phase in homeotropic orientation.