Polarization sensitive two-photon microscopy of DNA liquid crystalline phases

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DNA tightly packed in living cells as well as in concentrated solutions in vitro forms organized structures. They were explored by numerous techniques and recognized as lyotropic liquid crystalline phases (LLC) (1-3). Self-organized LLC DNA, besides its biological importance, is a useful model for the structural studies of organization of DNA in physiological conditions. This contribution reports on the investigation of the ordering of DNA by means of polarization-sensitive two-photon microscopy (TPM). Fluorescent dyes that binds to DNA can follow the organization of the strands (4). At first, LLC phases found in liquid crystalline cells as well as droplets were identified under polarized light microscope for DNA solutions doped with intercalator propidium iodide (PI) or groove binder Hoechst (H). Then, the samples were investigated by polarization sensitive TPM and the relative binding angles between the long axis of DNA helix and each of two dyes were determined. Analysis of the TPF signal in a function of polarization of incident light provides the local orientation of molecules associated with DNA and thus the orientation of DNA chains in micrometric sized LLC domains. The experimental results can be compared to theoretical calculations based on the model developed in (5).

References

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