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Interaction of semiflexible polymers and rod-like colloidal particles with strongly charged lipid membranes

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Understanding of the mechanisms of interaction of macromolecules and colloidal particles with lipid membranes is far from complete, and the questions related to role of local perturbation of the membrane properties in these interactions are still largely unsolved. In our experiments, we use strongly charged freestanding cationic lipid membranes (mimicked by supergiant unilamellar vesicles [1]), as well as supported cationic lipid bilayers showing fluid–gel phase coexistence. Interaction of DNA molecules with strongly charged freestanding cationic lipid bilayers leads to irreversible membrane-mediated coil–globule transition of membrane-absorbed DNA [2], an unexpected phenomenon on which we provide new experimental details. For single DNA molecules on supported cationic lipid bilayers we observe the compaction–decompaction behavior related to the appearance and disappearance of micrometer-sized gel domains in the supported membrane. This effect is fully reversible, in striking contrast to the irreversible DNA coil–globule transition on freestanding fluid cationic membranes. This clearly demonstrates the extremely important role of local membrane perturbations in membrane–macromolecule interaction. To elucidate the effect of the persistence length in these phenomena, we study the behavior of much stiffer semiflexible *fd* virus particles [4] under the identical conditions of interaction with freestanding and supported cationic membranes.

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