

How salt changes the pathways of DNA release from its polycationic complex?¹
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By fluorescence microscopy (FM) the conformational changes of individual double-stranded T4 DNA in the presence of two different polyions were investigated. First, it was observed that the polycation, poly(allylamine hydrochloride) (PAH) is able to induce the coil-globule transition in DNA macromolecules. By measuring the average long axis length, L , of DNA chains it was observed that PAH can change the conformation of DNA duplex from an elongated coil into a compact globular state due to the formation of interpolyelectrolyte complex (IPEC) with DNA polyanion. This is the result of the screening of electrostatic interactions between the segments of DNA and the release of numerous condensed counterions into the bulk of solution. It was also observed that the coil-globule transition is accompanied by the appearance of segregated regions on the outline of DNA molecules (beads-on-chain structure) which ultimately leads to the formation of compact globules.

In the next step we tried to release DNA from its complex with polycation via an interpolyelectrolyte exchange reaction with a polyanion, poly(styrene sulfonate) (PSS), at different ionic strengths. It was observed that PSS is able to release DNA from its IPEC with PAH at low and high salt concentrations. By monitoring the morphology of single DNA chains, it was revealed that the process of DNA release is governed by two completely different mechanisms. While at low salt concentrations the globule-coil transition is accompanied by the formation of microsegregated structures on the outline of DNA macromolecules and has a progressive character, at high salt concentrations the release of DNA follows an “all or none” scenario. In this way, an abrupt increase in ionic strength of the solution (from 0.01M to 1M) changes the character of globule-coil transition from a continuous to a discrete one.

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