Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Structure and dynamics of proflavine association around DNA

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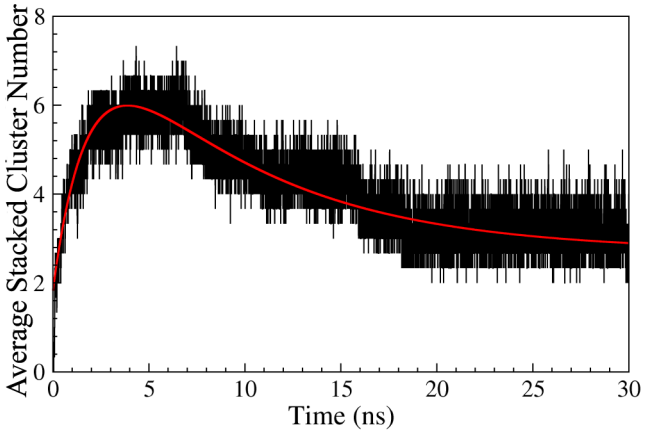

Figure S1. The average number of clusters of stacked proflavine molecules in solution. The red line is obtained by fitting the graph using the equation, $a_0 + a_3 * exp(-(t - a_1)/a_2) + a_6 * exp(-(t - a_4)/a_5)$. Here, the average number of clusters of proflavine after 15 ns is 3.2±0.5.

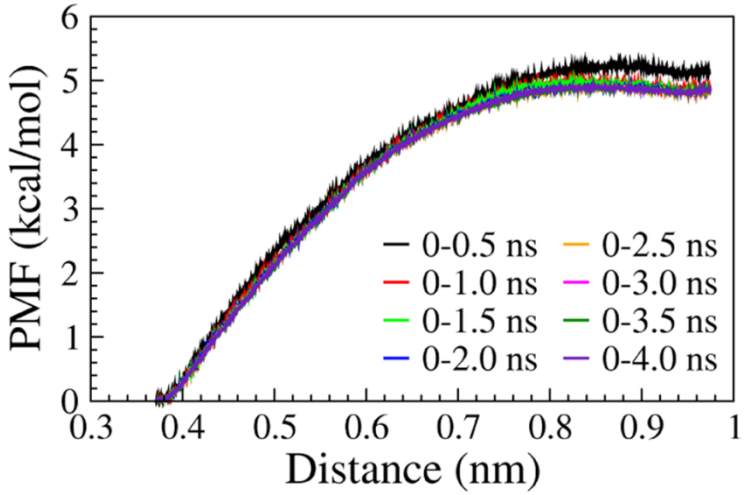

Figure S2. Convergence of the Potential Mean Force (PMF) obtained for the dissociation of proflavine dimer along distance between the COMs of two proflavine molecules.

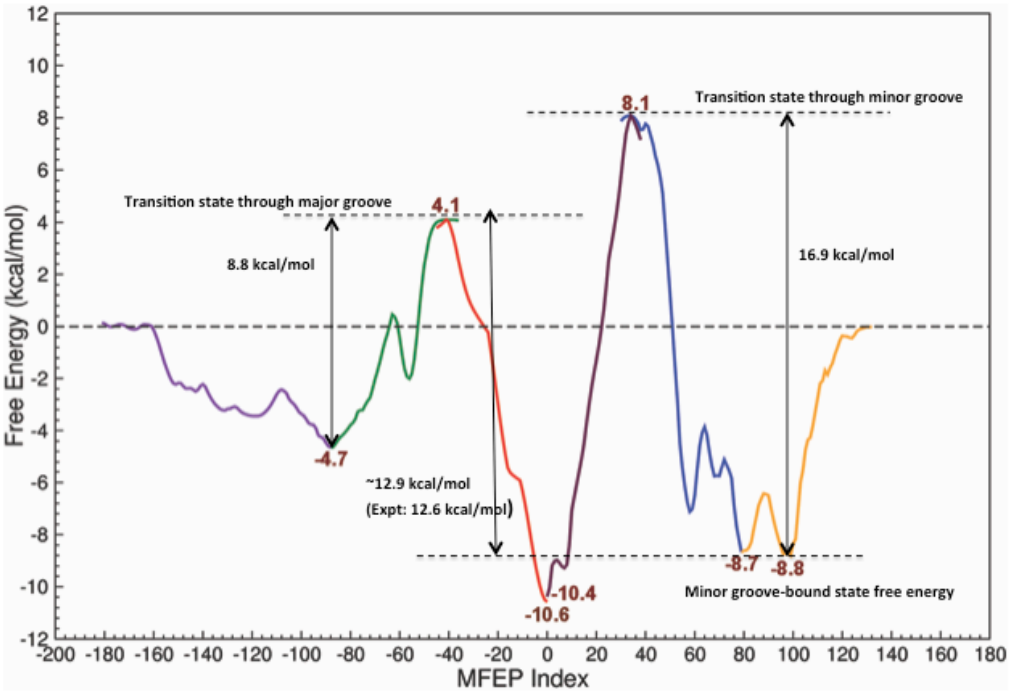

Figure S3. The complete free energy profile (from both major and minor grooves) of proflavine intercalation process, obtained through multiple metadynamics simulation reported in Ref. 1. This figure is redrawn from Ref. 1. Here, MFEP index denotes the minimum free energy path of intercalation. MFEP (minimum free energy path) index 0 indicates the intercalated state. Negative value of MFEP index denotes the major groove side and positive value indicates the minor groove side of the reaction coordinate. The barriers of intercalation process from the both major (8.8 kcal/mol) and minor grooves (16.9 kcal/mol) are indicated. The overall barrier can be roughly represented as the difference from the minor groove depths to the major groove barrier height, reproducing the experimental timescale for intercalation. Note that, we did not observe any other stable outside bound state rather than the one shown as minor and major groove-bound state.[1]

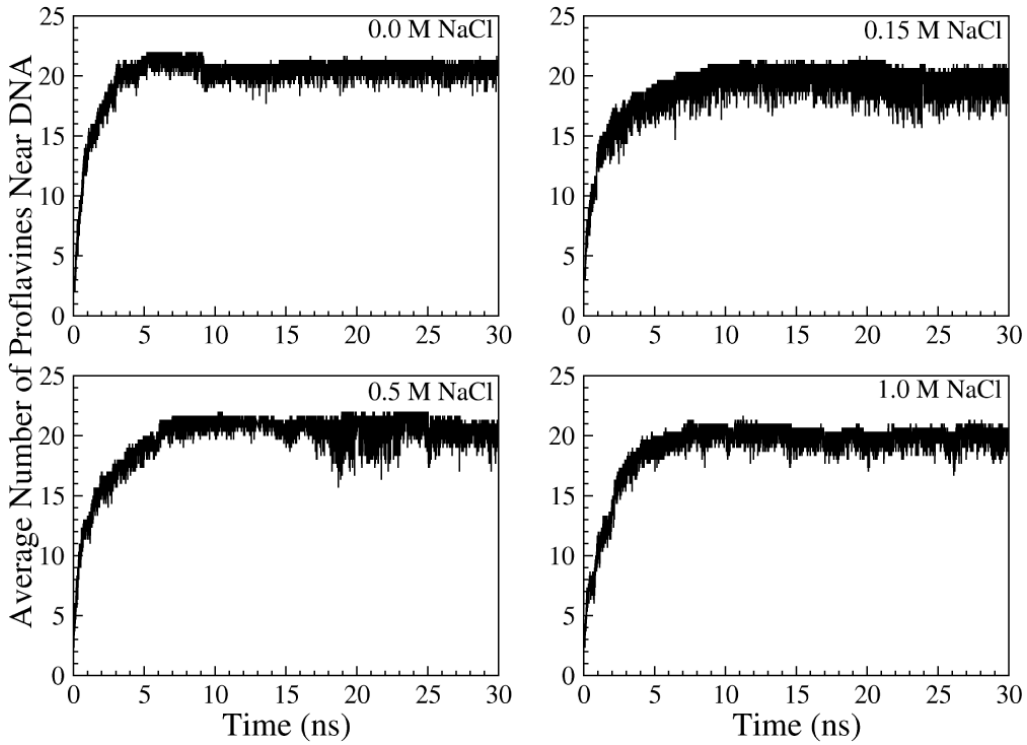

Figure S4. Average number of proflavines associated with DNA including stacked and unstacked molecules at different ion concentrations.

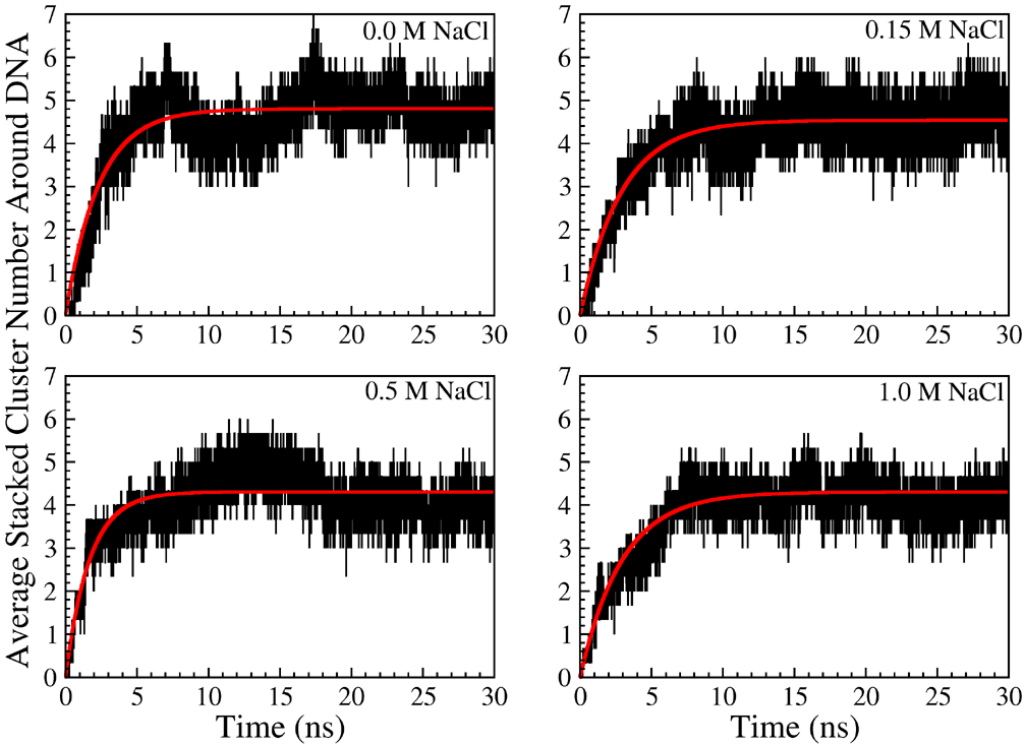

Figure S5. Average number of stacked clusters of proflavines around DNA at different ion concentrations. The red lines denotes fit using the equation, $a_0 - a_0 e^{-(t/\tau)}$.

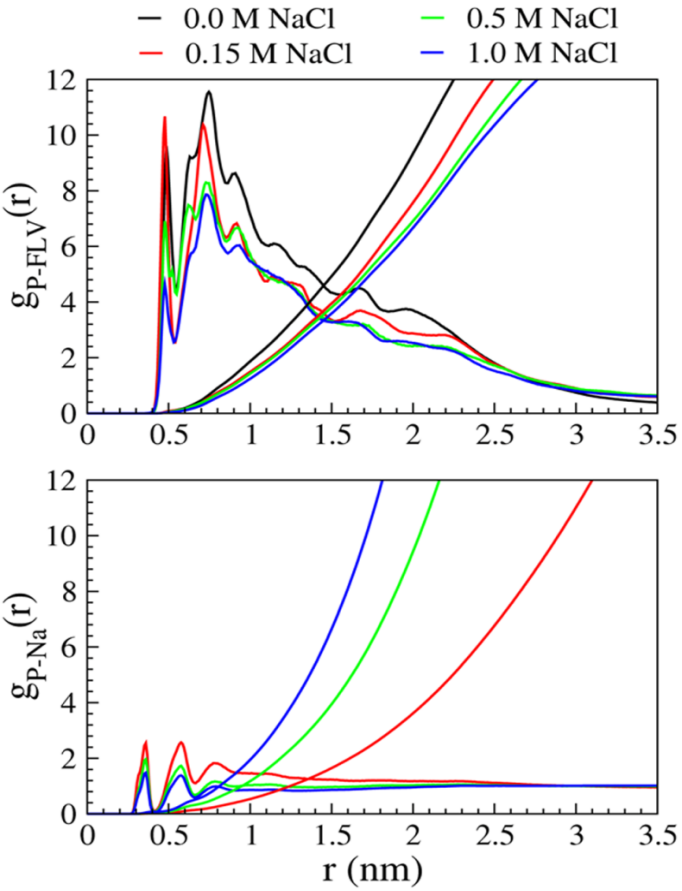

Figure S6. Radial distribution function and co-ordination number of proflavine molecules and Na+ around backbone of DNA. (a) Proflavine around phosphate group of DNA (b) Na+ around phosphate group of DNA.

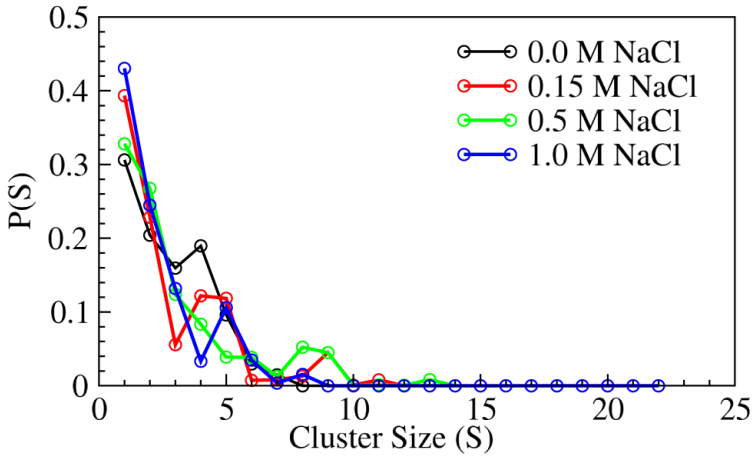

Figure S7. Distribution of different sizes of clusters of proflavine around DNA.

References

1. Sasikala, W. D.; Mukherjee, A., Intercalation and De-Intercalation Pathway of Proflavine through the Minor and Major Grooves of DNA: Roles of Water and Entropy. *Phys. Chem. Chem. Phys.* **2013,** *15*, 6446-6455.