Electronic Supporting Information

Effects of the Structure of Lipid-based Agents in their Complexation with a Single Stranded mRNA fragment: a Computational Study

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Initial Configurations

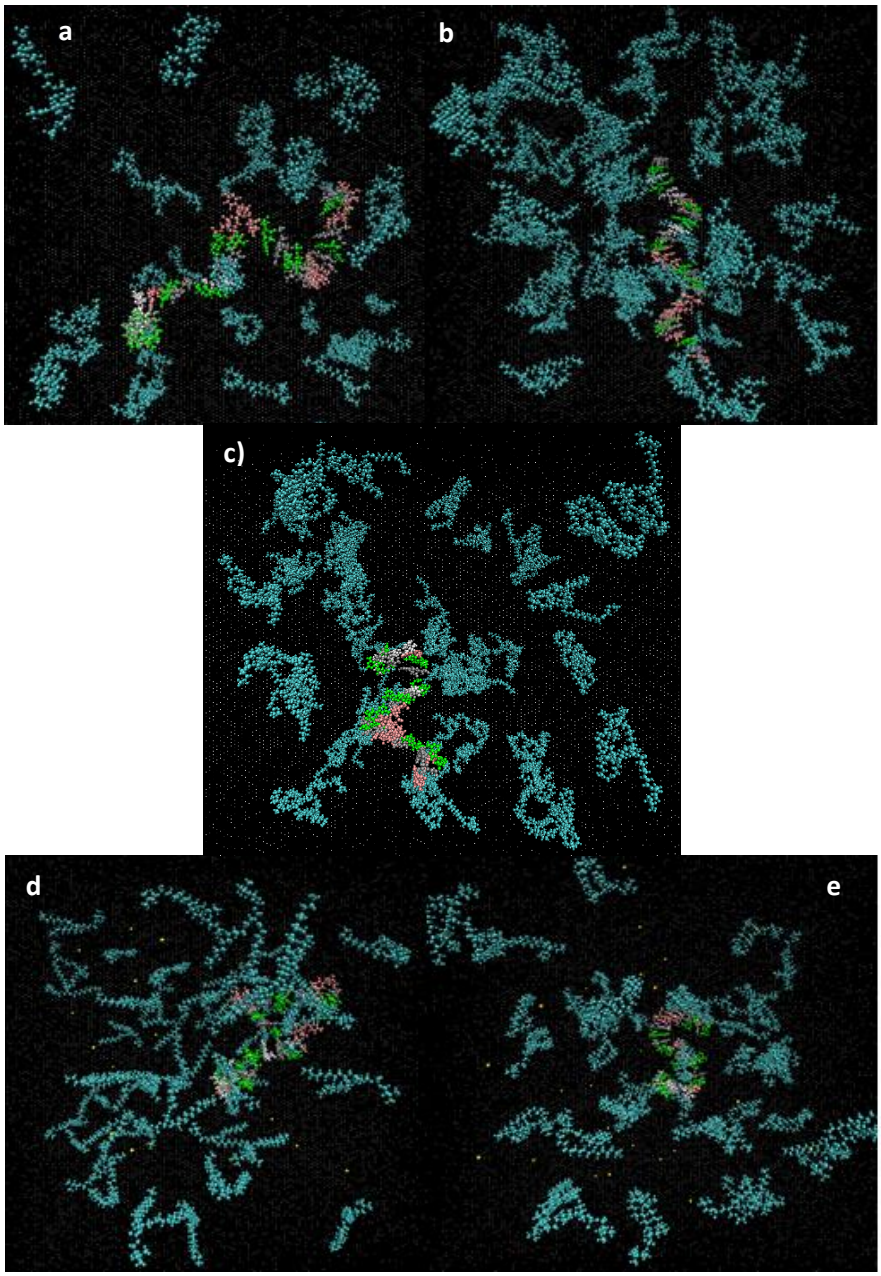


Figure S1: Typical initial configurations of lipid molecules complexed with the oligonucleotide mRNA for a) DM; b) DML; c) OfDegLin; d) DPPC and e) DLPC systems. Water molecules are shown as ghost for clarity.

Nucleotide sequence for the mRNA fragment

G A U A U U C A G A U G A C C C A G A G C C C G A C A G C

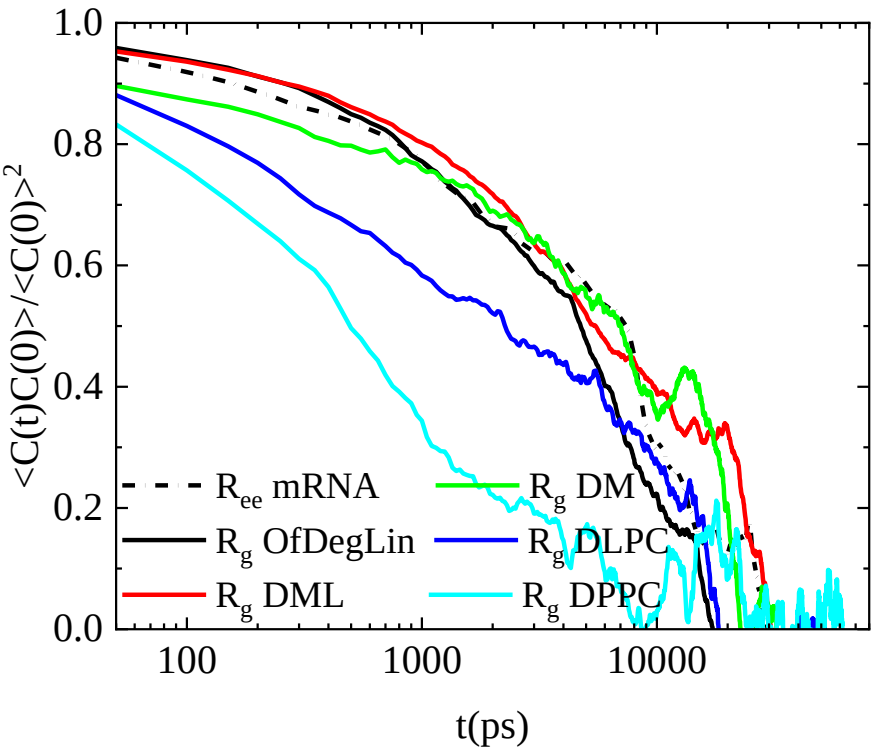
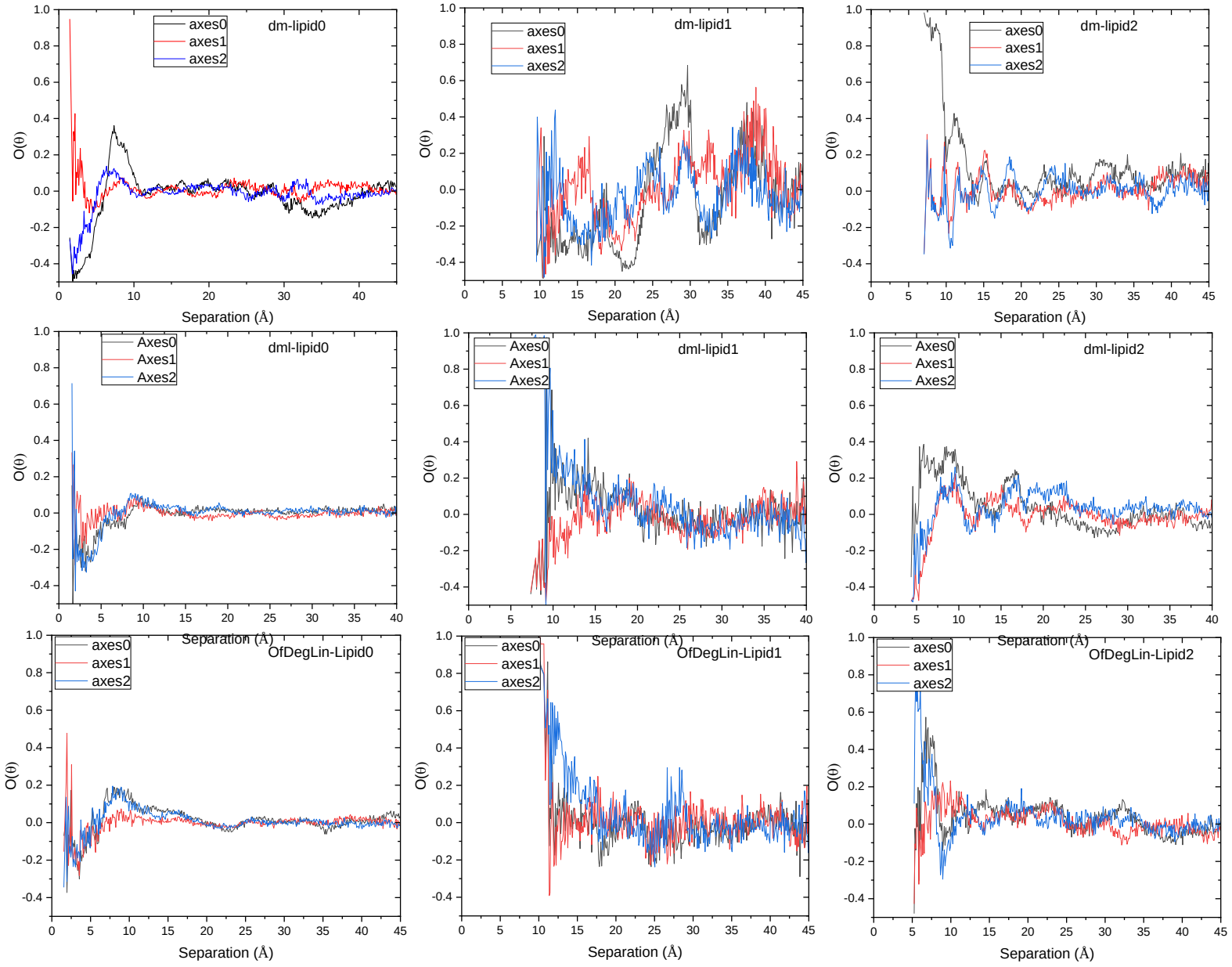


Figure S2: Autocorrelation functions of the e-e distance of the RNA chain ($C(t)=R_{e\text{-}e}(t)$) and the radius of gyration ($C(t)=R_g(t)$) of the complexation agents.

Orientational order parameter between the complexation agents in formed clusters.

The orientational order parameter between individual complexation agents within the formed clusters, were calculated through the expression $O(\theta)=\frac{1}{2}\left(3\left\langle\cos^2\theta\right\rangle-1\right)$. Here θ is the angle between the direction of an eigenvector of the inertia tensor of a lipid, and the corresponding eigenvector of a different lipid of the same kind. This was calculated as a function of the separation between the centers of mass of the lipids. O(θ) assumes values of 1 if the orientation of the lipids is parallel, -0.5 when there is a mutually perpendicular arrangement along the examined direction and 0 if there is no preferred orientation with respect to the examined direction. The figures below depict the orientational parameter along the 3 eigenvectors of the inertia tensor for each lipid.



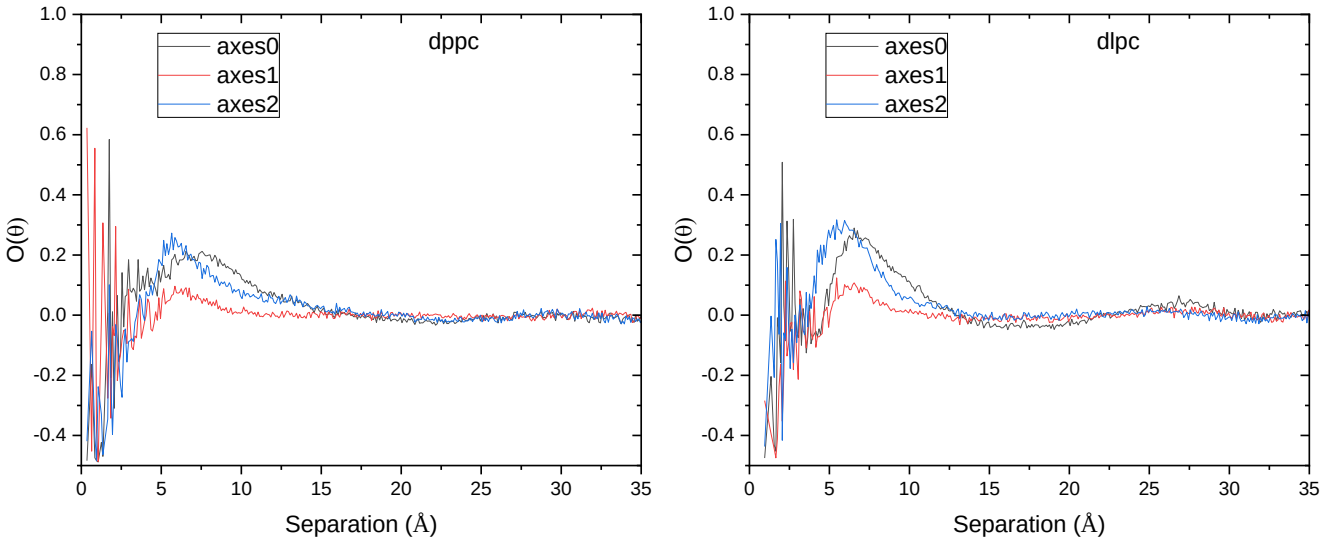


Figure S3: Orientational parameter along the directions of the 3 eigenvectors of the inertia tensor for each lipid.

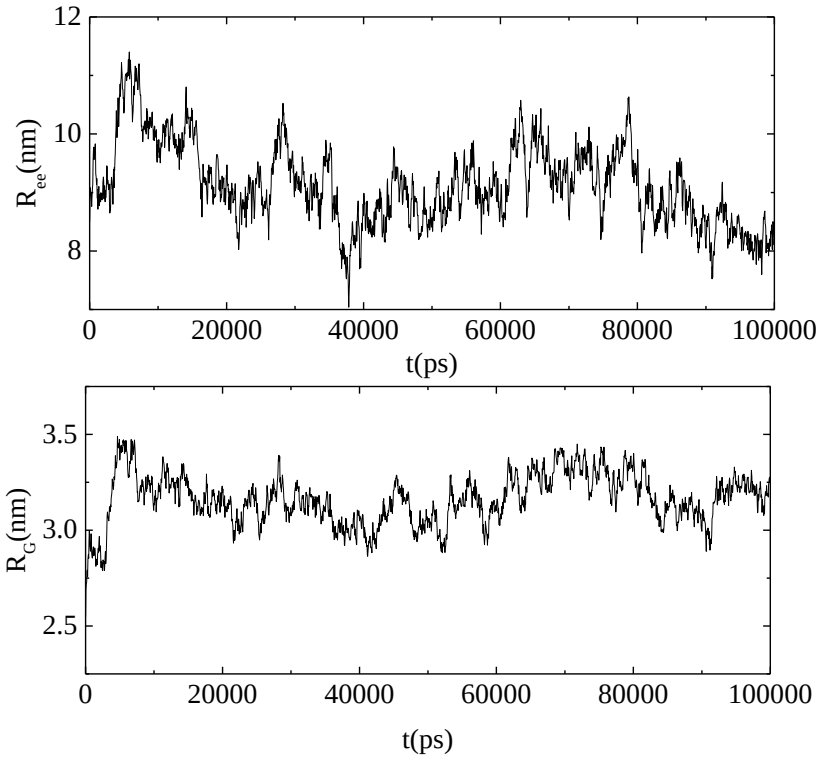


Figure S4: Time variation of the radius of gyration and the end-to-end distance of the RNA fragment in water, in the absence the complexation agents.

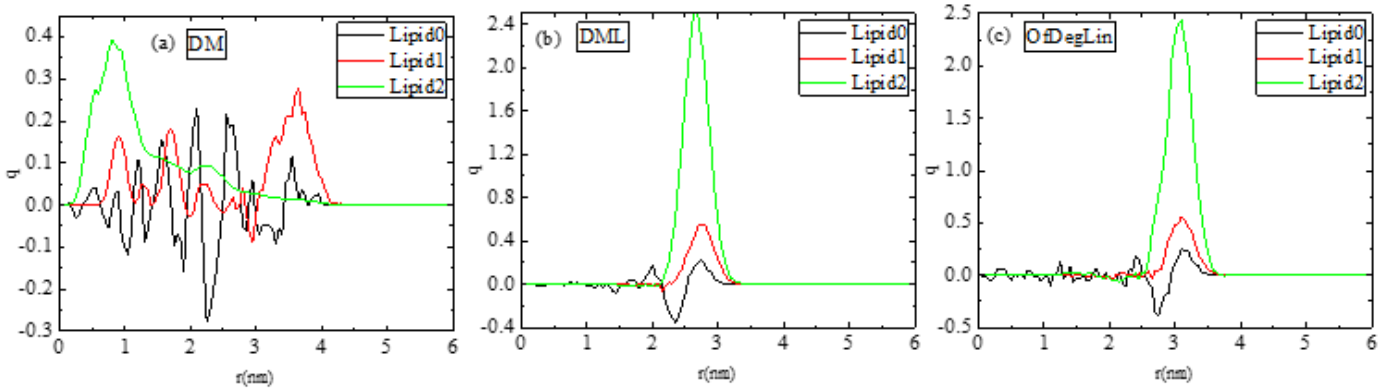


Figure S5: Charge distributions of the ionizable complexation agents which bear different overall charge. a) DML b) DM c) OfDegLin. The charge is expressed in electron charge units.

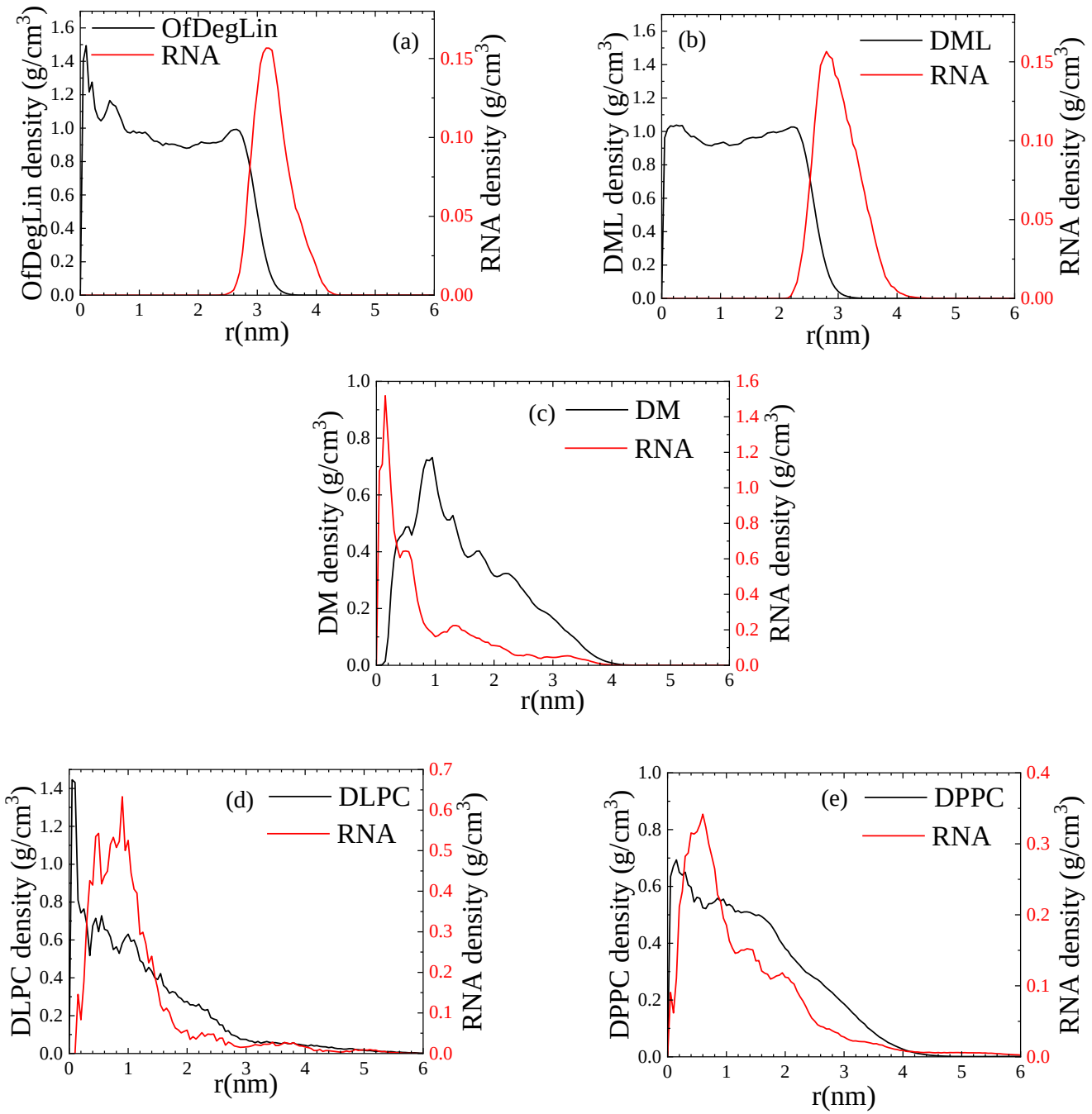


Figure S6: Density profiles of the complexation agents and the RNA with respect to the center of mass of the formed cluster.

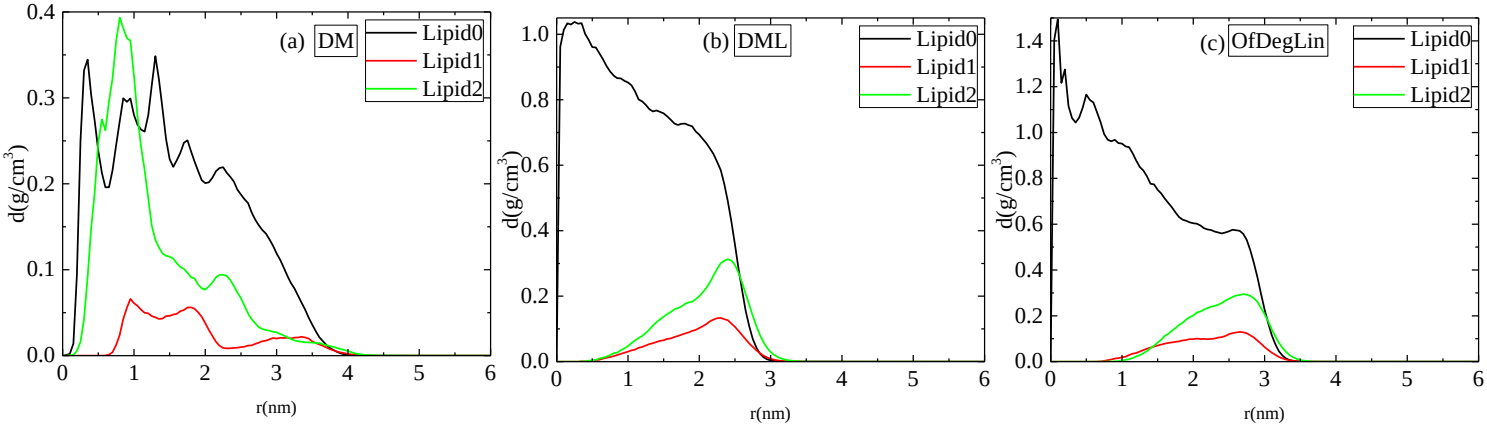


Figure S7: Density distributions of the ionizable complexation agents which bear different overall charge: a) DM b) DML c) OfDegLin.

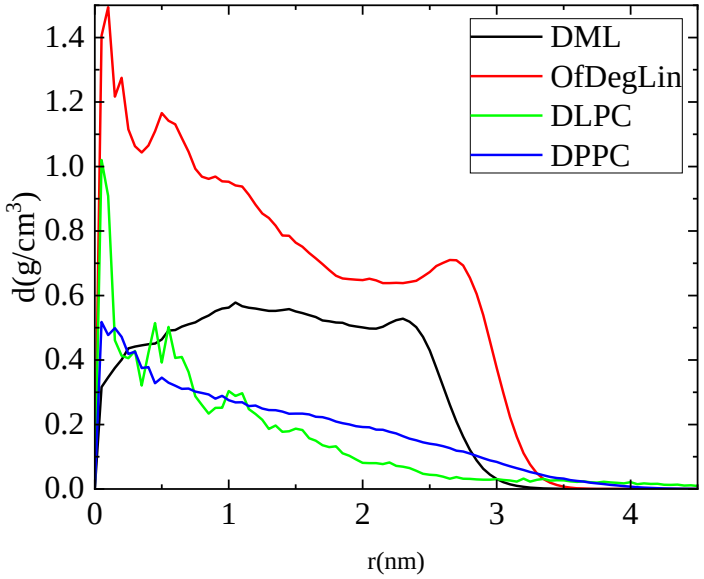


Figure S8: Mass density profiles of the tails in clusters formed by the complexation agents DML, OfDegLin, DLPC, DPPC (single cluster formation). Distance 0 corresponds to the geometric center of the cluster.

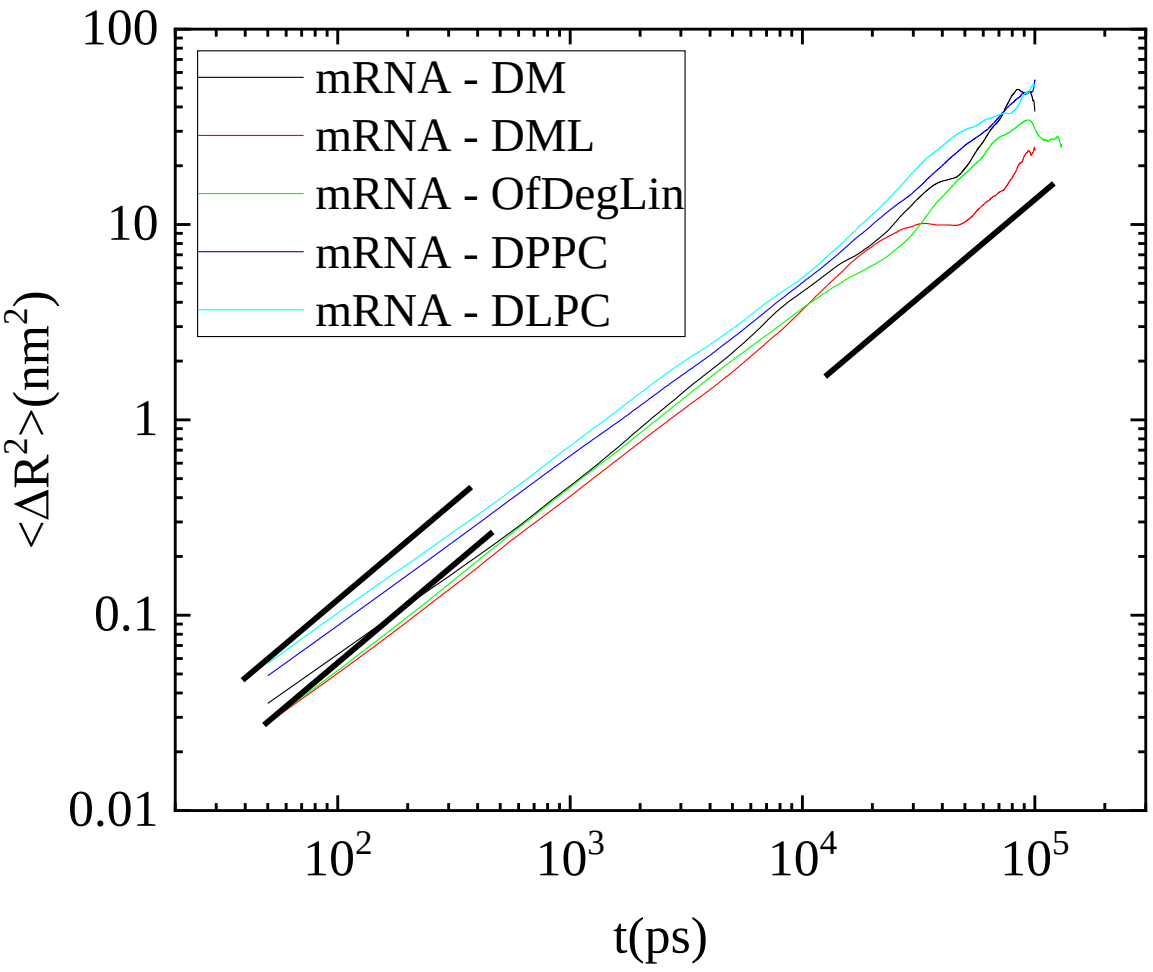


Figure S9. MSDs arising from the center of mass of the complexation agents, for the part of the trajectory beyond 100ns from the start of the production run, when self-assembled groups of lipids have already been associated with mRNA. The thick short straight lines denote a slope of 1.

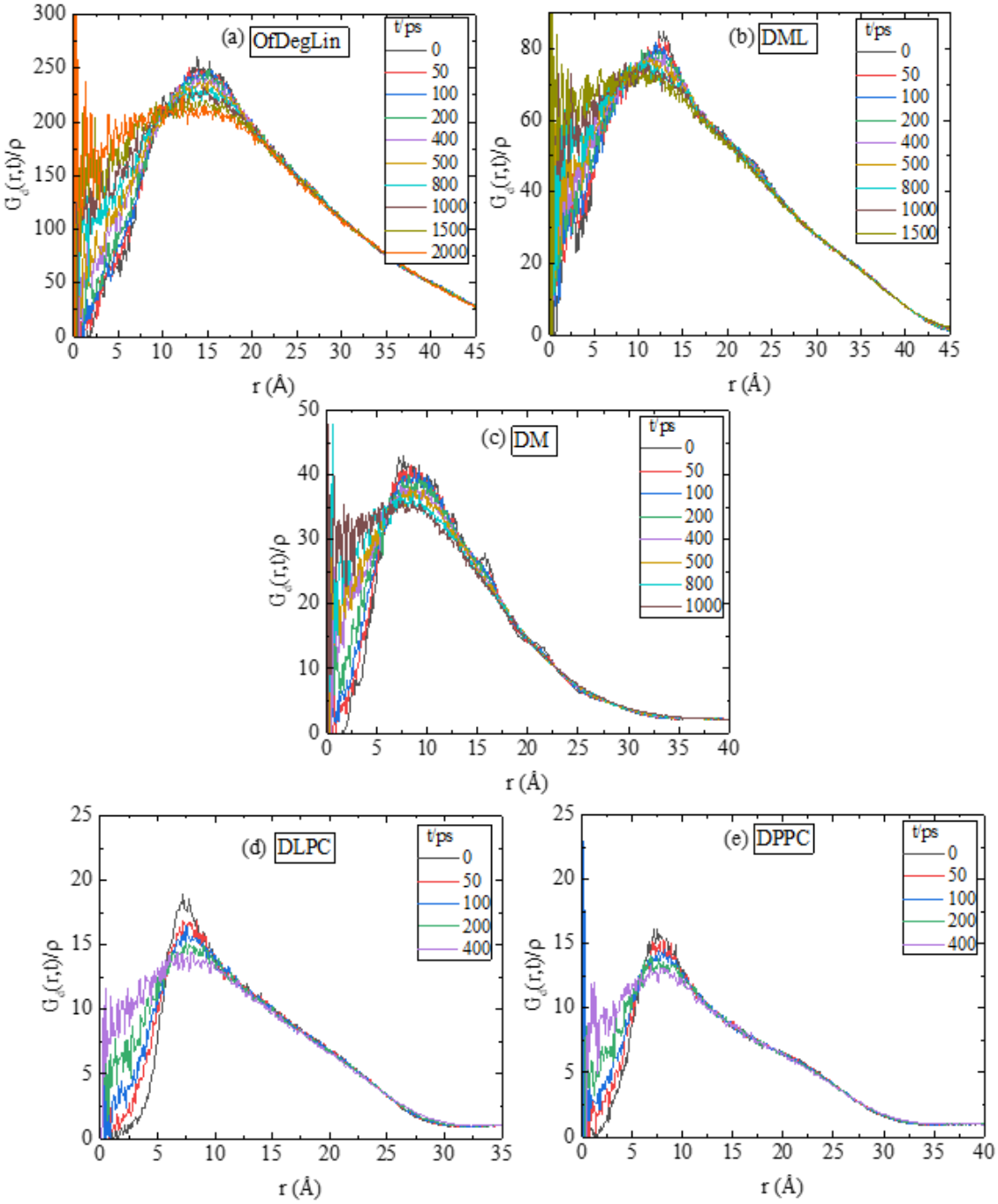


Figure S10: Distinct van Hove correlation functions arising from the centers of mass of the complexation agents, for different time intervals.