



Accessibility and Diffusion of Transcription Factor Complexes into 1Mbp Chromatin Domains

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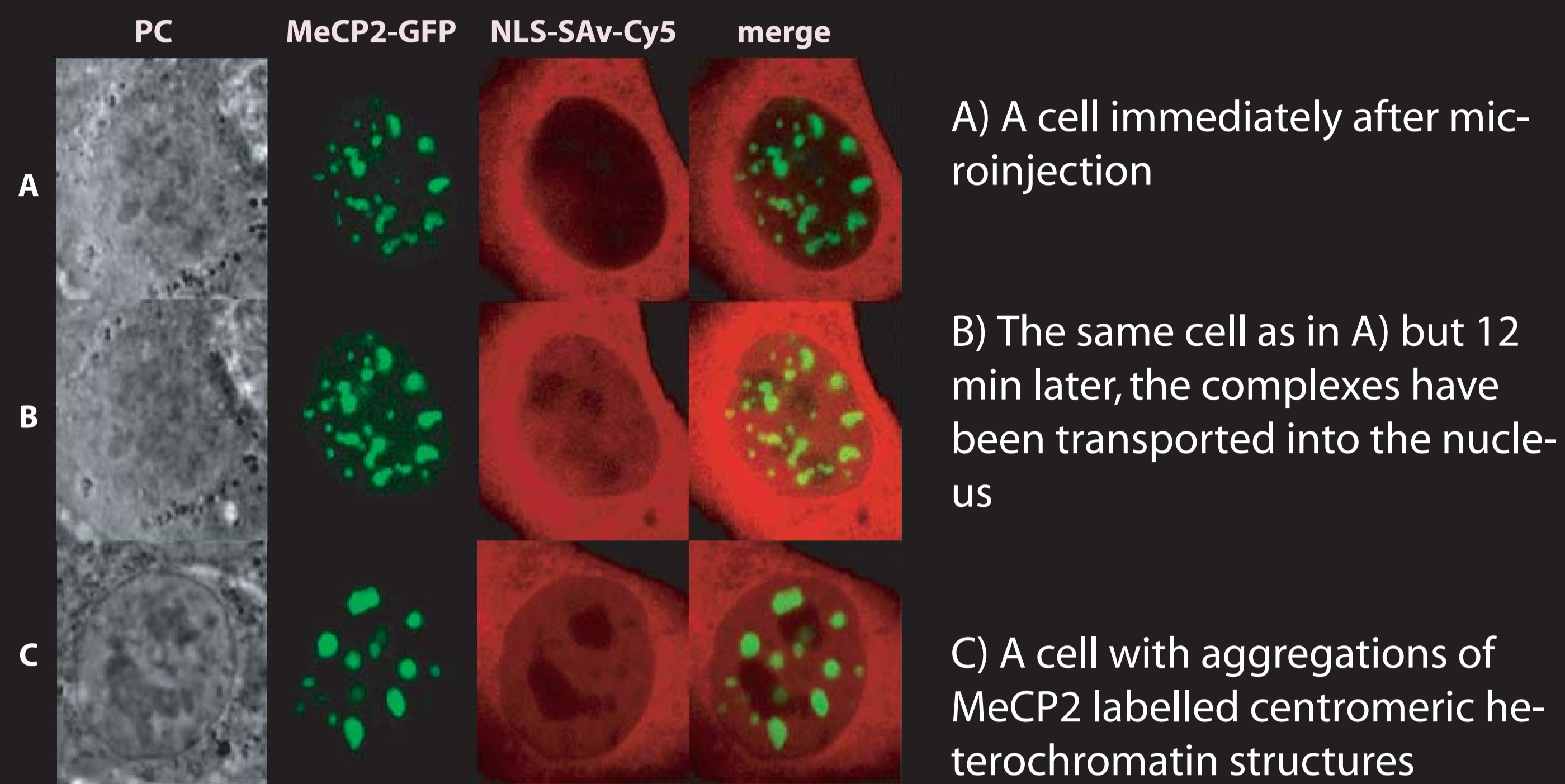
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Background

NLS-streptavidin-Cy5 steady state distribution in mouse cells expressing MeCP2-GFP to label heterochromatin



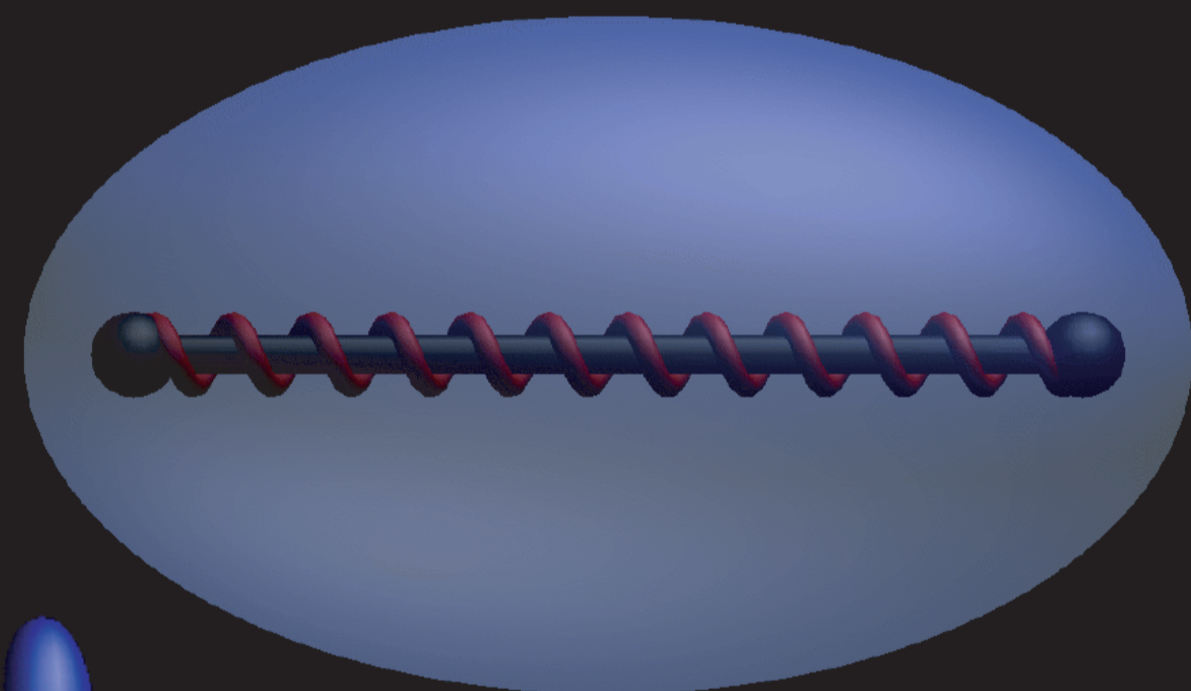
The cells were injected into the cytoplasm with Cy5 fluorescently labelled complexes of streptavidin (SAv) and a biotinylated nuclear localization signal peptide (NLS-biotin).



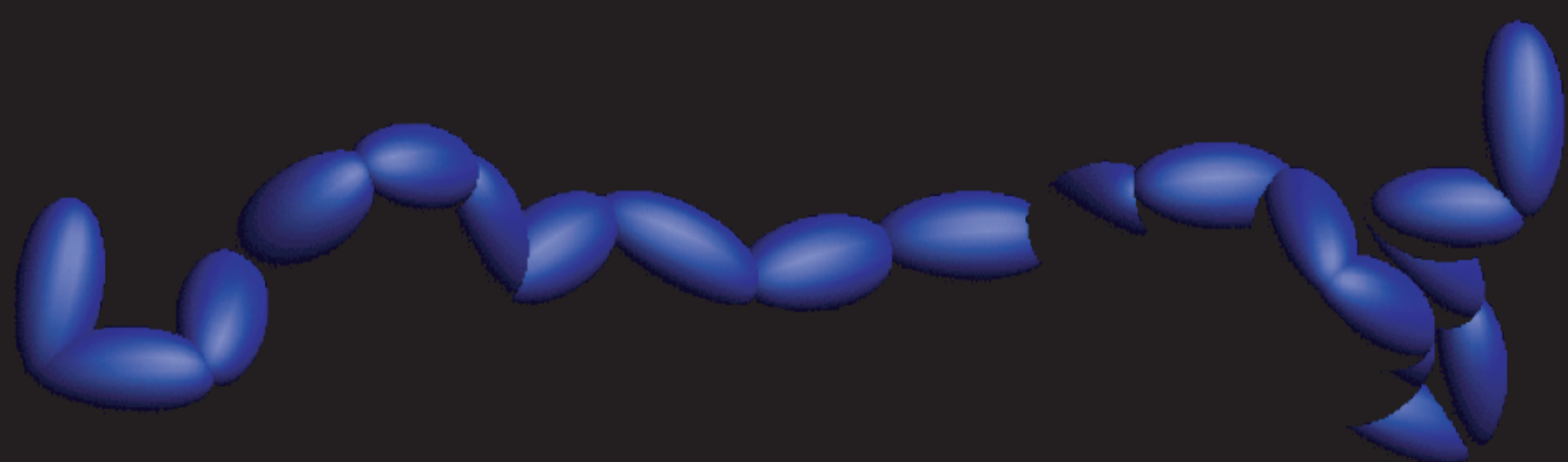
How do particles diffuse into the heterochromatic clusters?

Methods

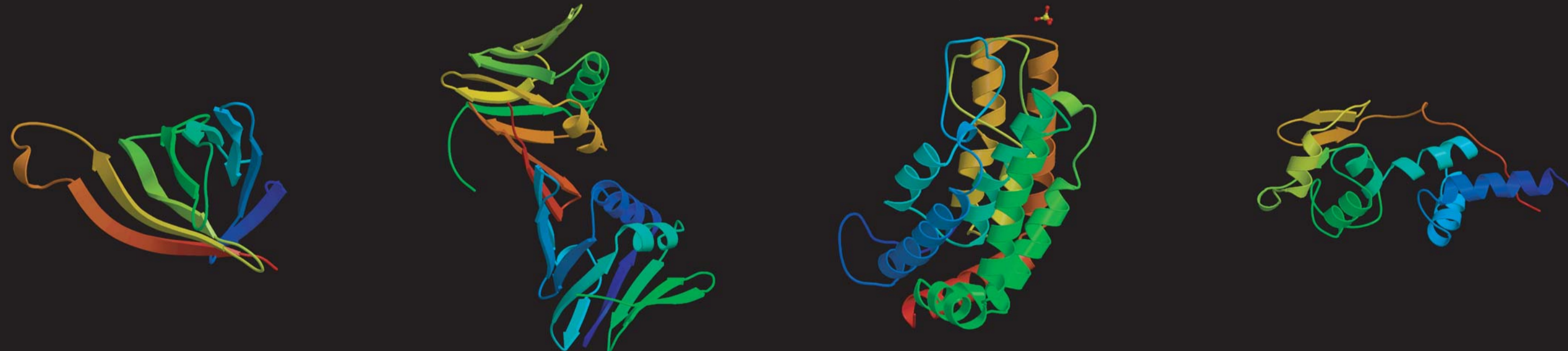
For our Brownian Dynamics Simulation we use the Ellipsoidal Model (K. Zimmer, D.W. Heermann 1994). Individual Monomers are modelled as Ellipsoids with a confocal potential.



The chromatin fiber is modelled as focally jointed ellipsoids.



Streptavidin GFP-PCNA Trimer RNA Polymerase II Ribosome



Streptavidin ellipsoid size: GFP-PCNA Trimer ellipsoid size: RNA-Polymerase II ellipsoid size: Ribosome ellipsoid size:

a = 5 nm a = 11 nm a = 26 nm a = 30 nm
b = 4 nm b = 11 nm b = 14 nm b = 20 nm

(Streptavidin Mutant N23A at 2.18A)

(Proliferating Cell Nuclear Antigen (Pcna) Homolog From Pyrococcus Furiosus)

(Crystal Structure Of The Double Bromo-domain Module From Human Tafii250)

(Solution Structure Of Ribosomal Protein S4 delta 41, Refined With Dipolar Coupling)

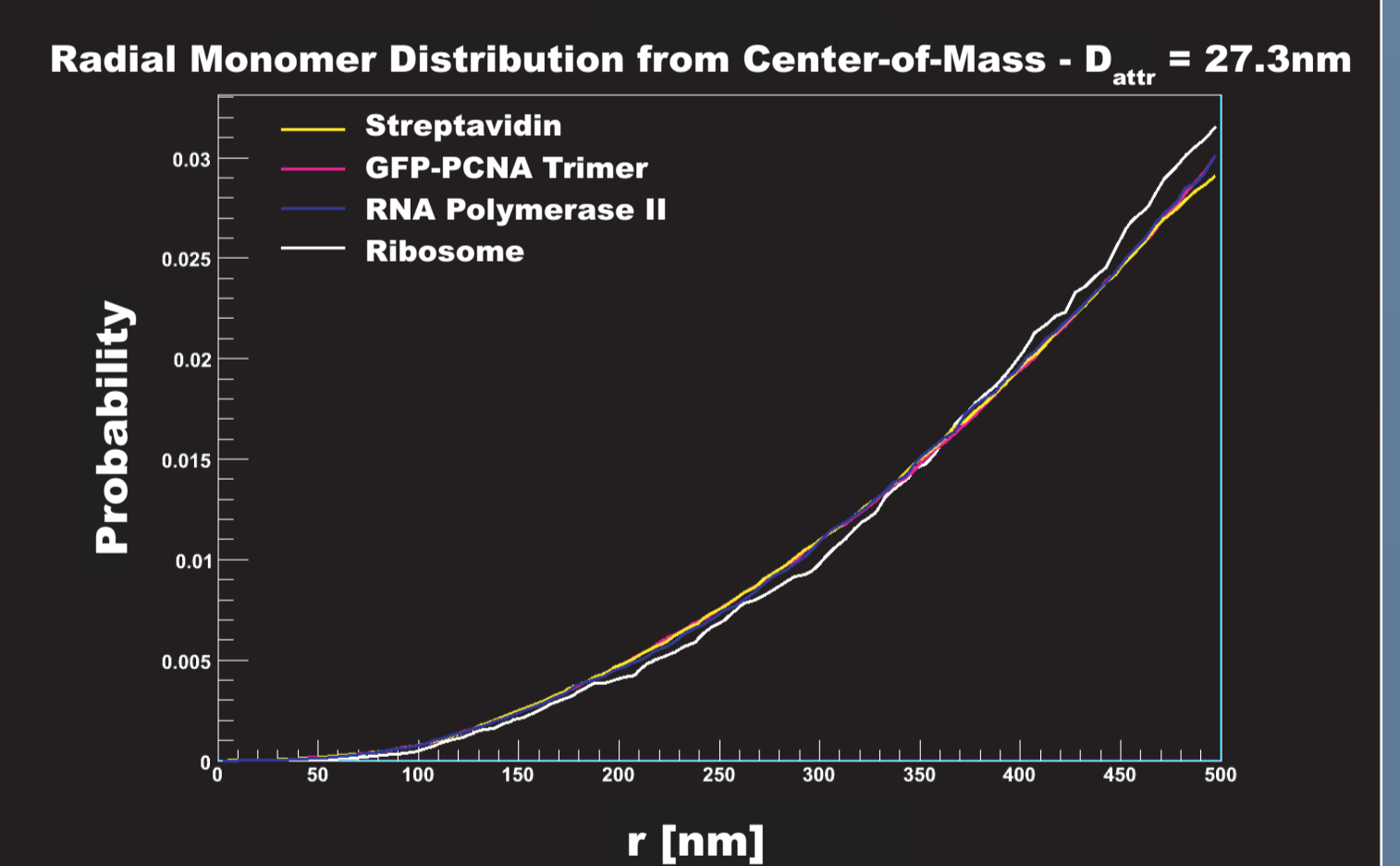
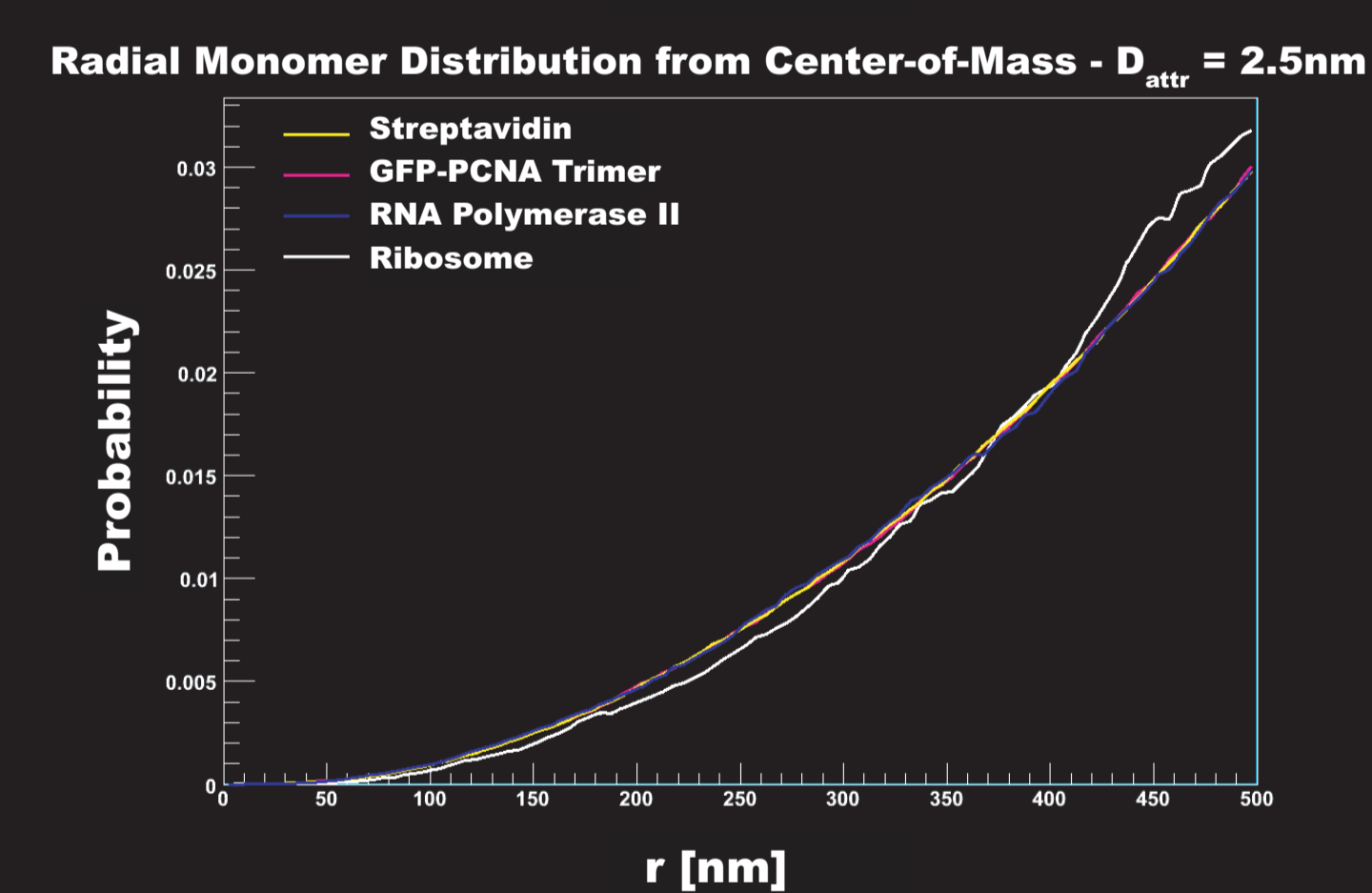
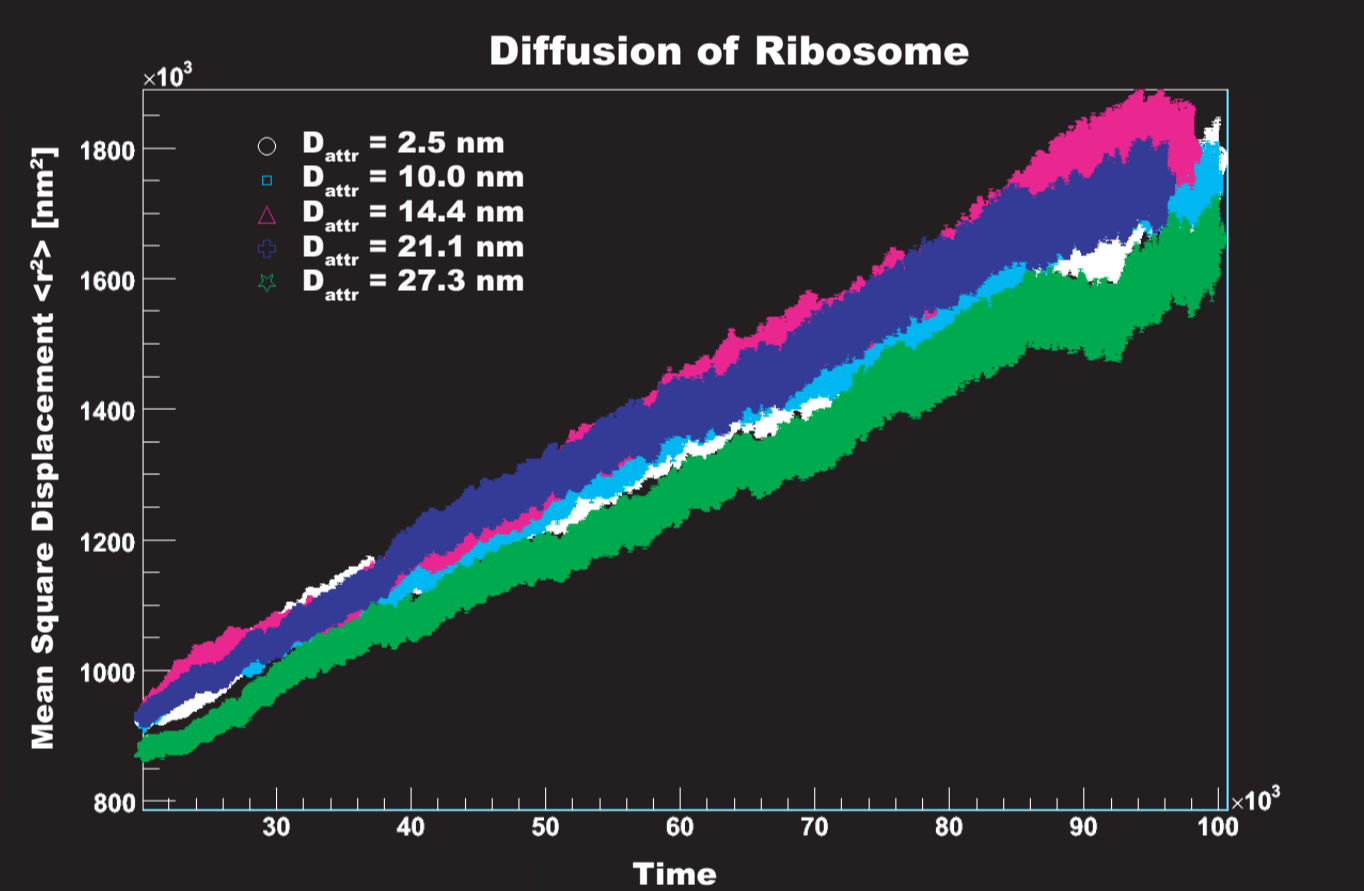
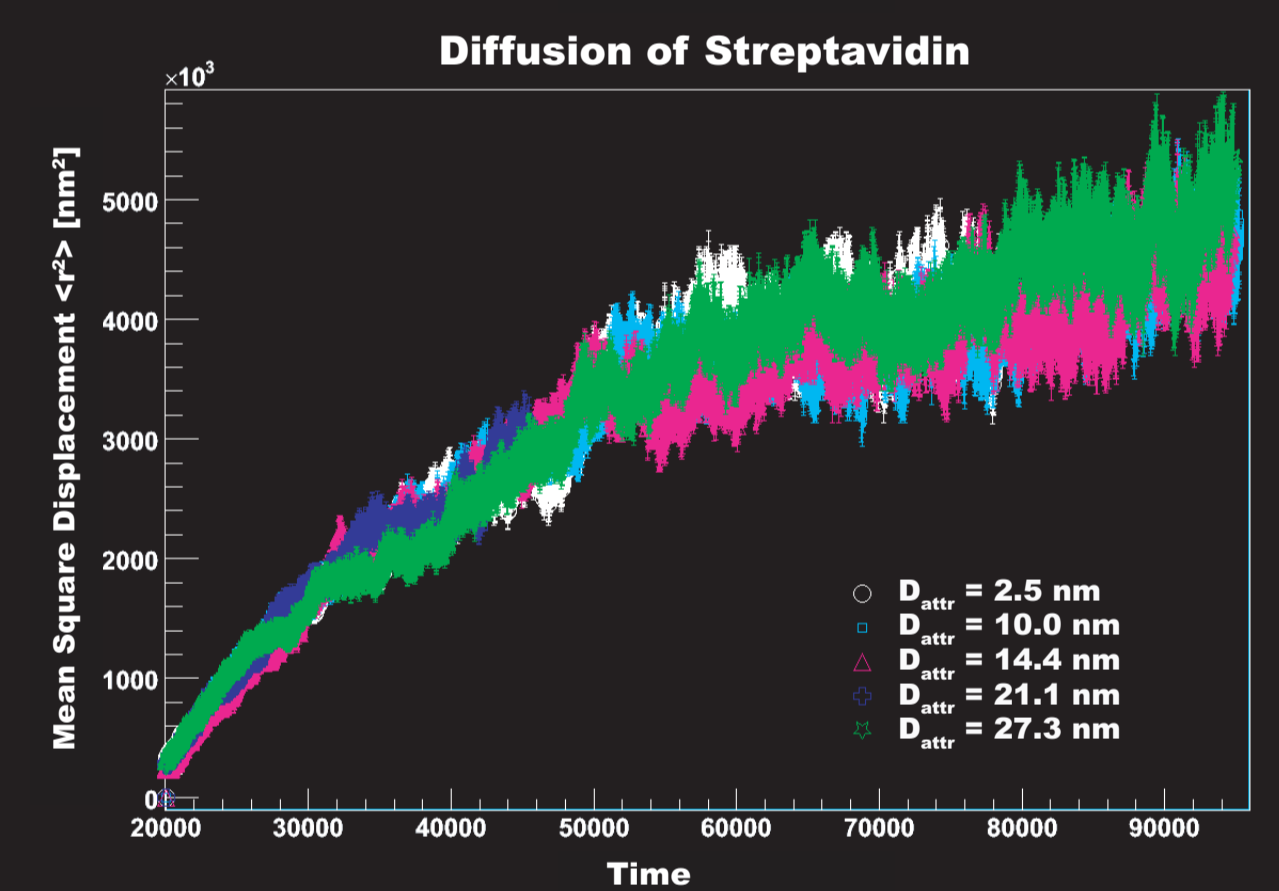
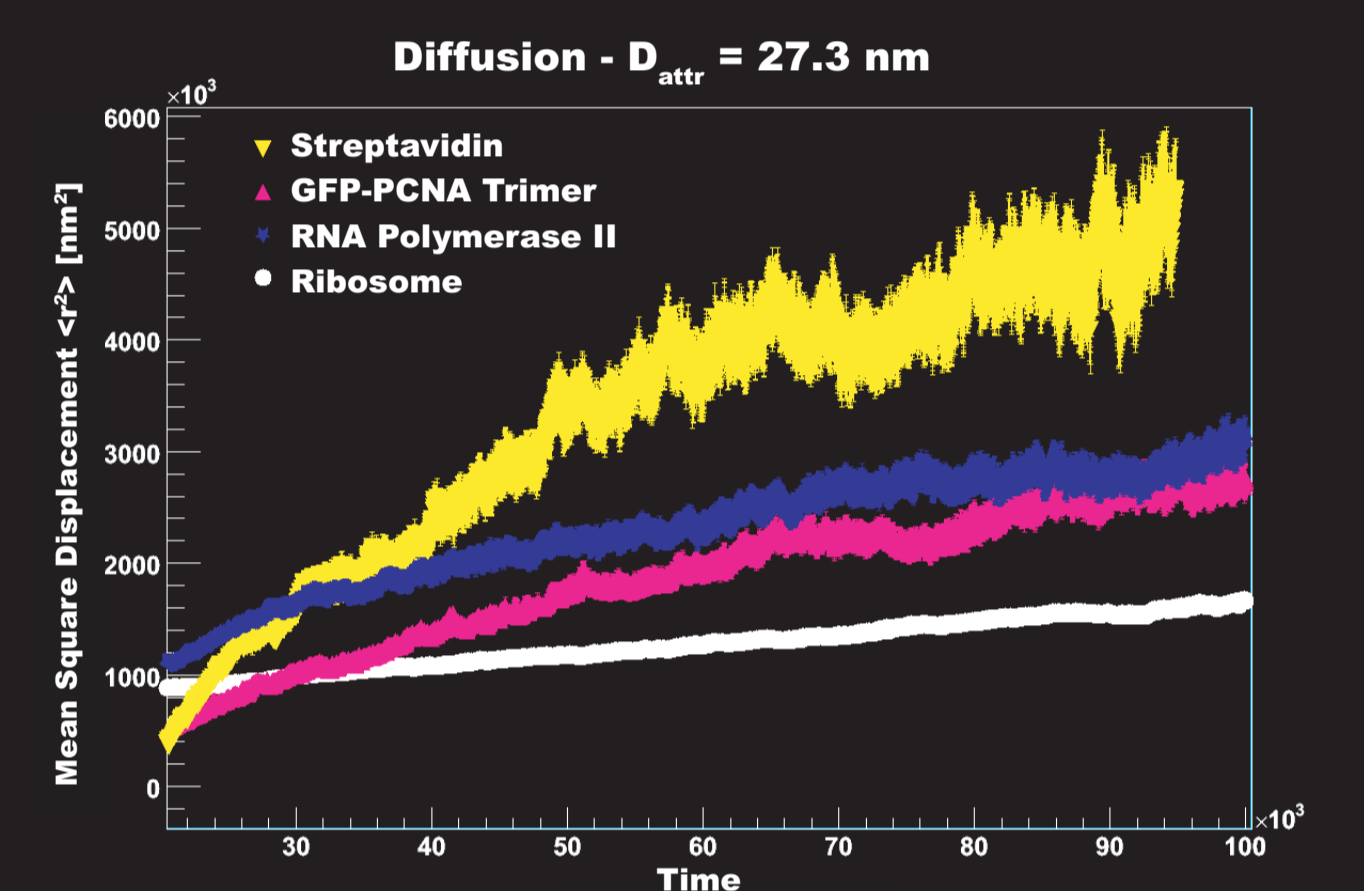
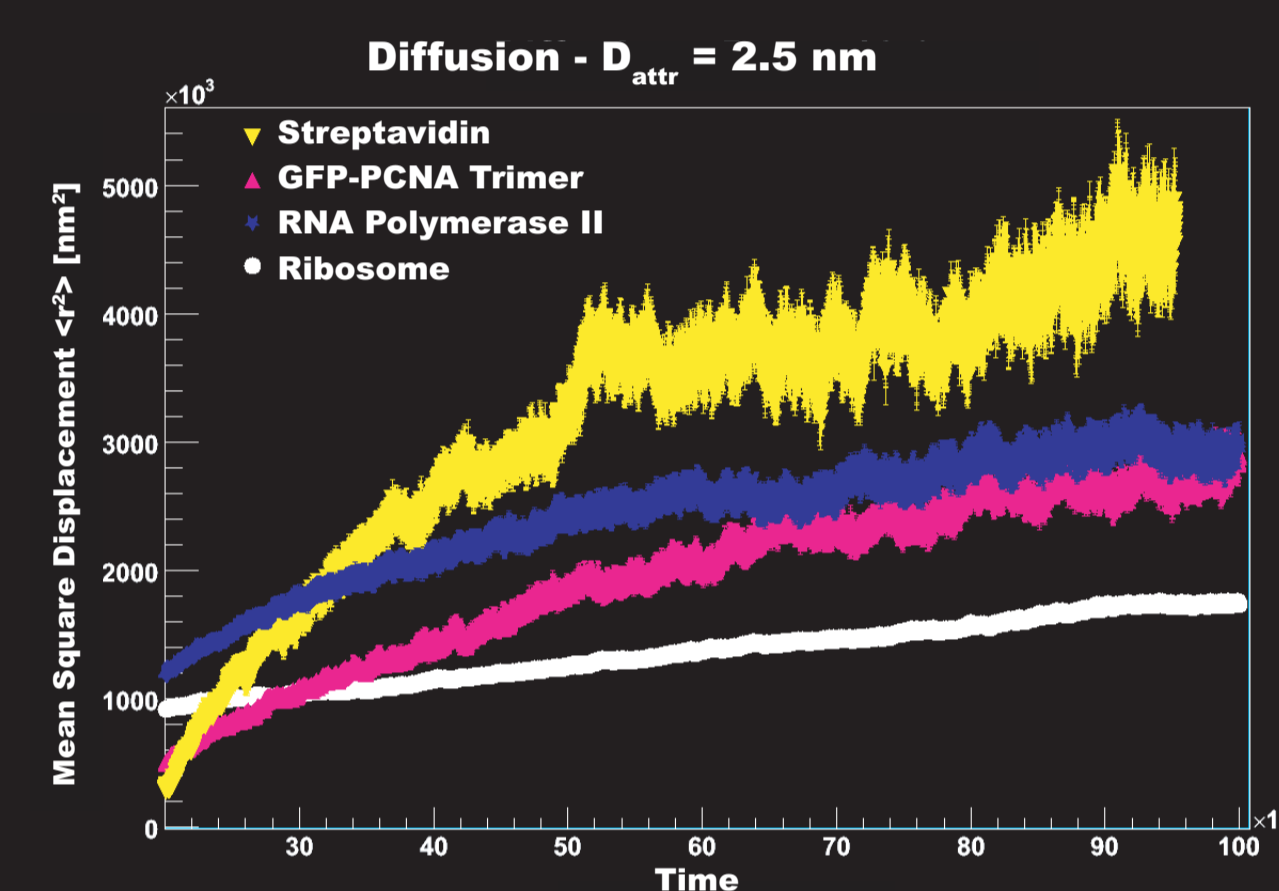
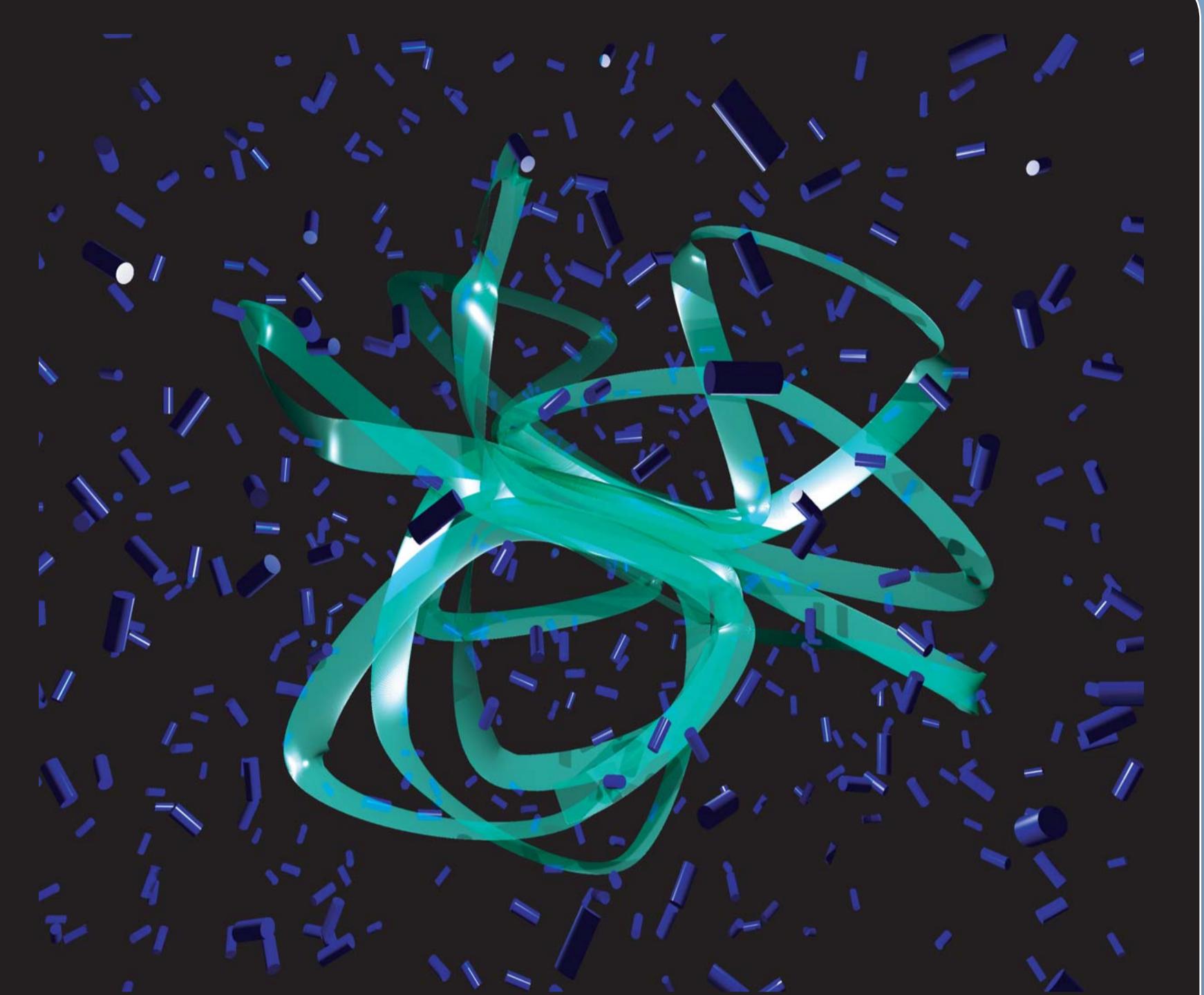
Results

The simulation box contained a 1 Mbp chromatin rosette and 1.000 diffusion particles.

The box length was 1.000 nm and the boundary conditions were periodic.

The diffusive properties and concentration profiles were analyzed.

Each run produced about 10.000 configurations.



Conclusion

- Streptavidin, GFP-PCNA Trimer and RNA-Polymerase II do obstructed diffusion.
- Ribosome does regular diffusion.
- The ribosome concentration in the center of the rosette is less than Streptavidin, GFP-PCNA Trimer or RNA-Polymerase II, whose concentrations are essentially the same.
- Diffusive properties and concentration are not influenced by different binding lengths in the center of the rosette.

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