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Kinetic modeling of nucleosome dynamics on a chromatin fibre

The eukaryotic genome is packaged inside nucleus by histone octamers that bind with DNA forming a basic repeating structural unit called nucleosomes—about 147 base-pairs (bp) of DNA is wrapped around the histone octamer. Recent evidence suggests existence of stable sub-size nucleosomes < 147 bp. This may be due to the fact that the DNA ends of the nucleosomes can unwrap and rewrap. Indeed it has been shown that transcription factors can invade/bind to unwrapped nucleosomes. Interestingly, not only nucleosome formation but also the unwrap-rewrap dynamics has been shown to depend on the underlying DNA sequence. How these sub-nucleosomes are organized in the genome and affects nucleosome occupancy and positioning is not fully understood. Here we report a preliminary theoretical study of nucleosome dynamics on some finite-size DNA. We want to know the minimal physical conditions (genome length, initial nucleosome configurations, relaxation time, and unwrapping rates) in the kinetic model such that the nucleosome occupancy per base-pair approaches to the equilibrium models.

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