

Crumpled globule model of chromosomes

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(Dated: May 22, 2010)

A brief review of an old theoretical idea in the light of new experiments and new simulations.

The idea of crumpled globule was originally formulated [1] as a possible long living kinetic intermediate on the pathway of a homopolymer chain collapse. The relevance of crumpled globule conformation to DNA organization in interphase chromosomes was hypothesized in [2]; see also [3]. The main idea is that crumpled conformation is the entropically dominant one for the long chain collapsed without knots. In this sense, the crumpled conformation of a single chain should be similar to conformations of unconcatenated unknotted ring chains in a melt. Accordingly, the recent large scale simulation of the melt of rings [4] was interpreted as a model of “chromosome territories” [5], where different polymers remain segregated (see Figure 1) for purely topological reasons.

The idea of DNA packed in chromosomes in the crumpled globule conformation was rejuvenated in the recent experimental work [6].

The fractal and scaling properties of crumpled globules are rather unusual and much remains to be understood about them.

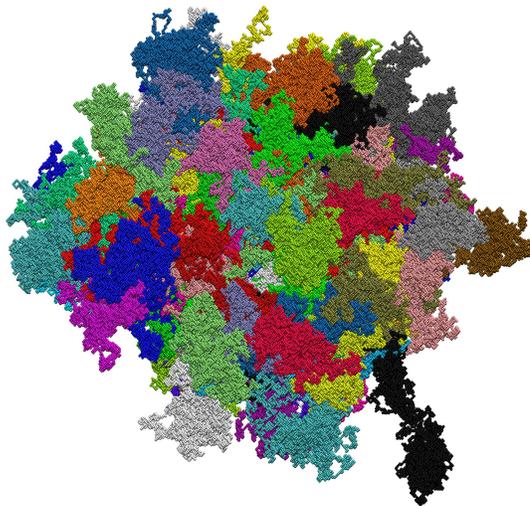


FIG. 1: Ring polymers in melt remain segregated provided rings are topologically untangled.

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