Understanding the Effect of Cohesin on the Coarse-Grained Chromatin Harmonic Spring

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Modelling chromatin as a Gaussian spring

$$k = \frac{3k_BT}{\langle R^2 \rangle}$$

$$\langle R^2 \rangle = 2L_PL_C$$

$$\tilde{k} = \frac{3k_BT}{\langle R^2 \rangle}\frac{1}{\alpha(c_0/\bar{c})^4}$$

The free energy functional F was non-dimensionalized using the energy scale $[E]$

$$F = \iint dxdy\alpha(c - c_0)^4 \cdots$$

$$[E] = \alpha(c_0/\bar{c})^4[L]^2$$

Using the end-to-end distance to estimate the rest length

$$\langle R^2 \rangle = \tilde{d}^2[L]^2 = 2L_PL_C$$

$$\tilde{k} = \frac{3k_BT}{\tilde{d}^2[L^2]}\frac{1}{\alpha(c_0/\bar{c})^4}$$

$$\tilde{k} = \frac{3k_BT}{[E]}\frac{1}{\tilde{d}^2}$$

The energy scale depends on the critical temperature and light or dense phase concentrations of nuclear proteins as well as the diffusivity and degradation (consumption) rate of nascent RNA.

$$\tilde{k} \propto \frac{1}{\tilde{d}^2}$$

Cohesin shortens the contour length of chromatin, decreasing $\tilde{d}$. Chromatin moves along the contour of this curve.