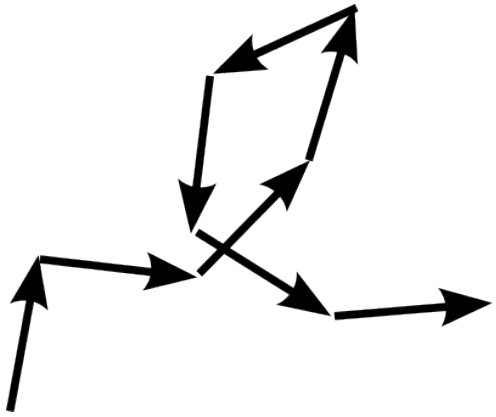
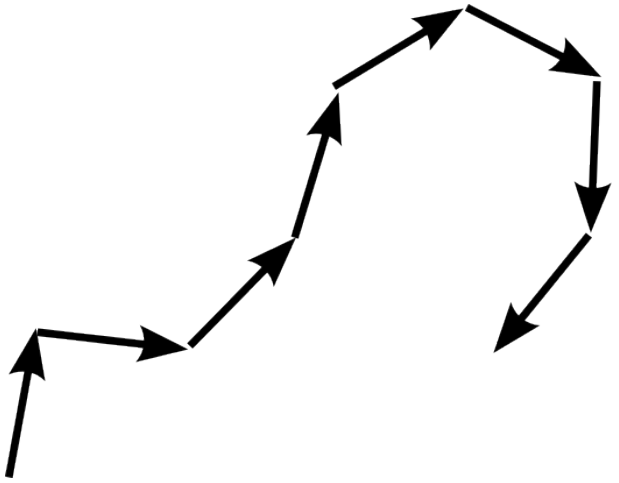
Random coil and swollen coil are two basic models of local polymer statistics

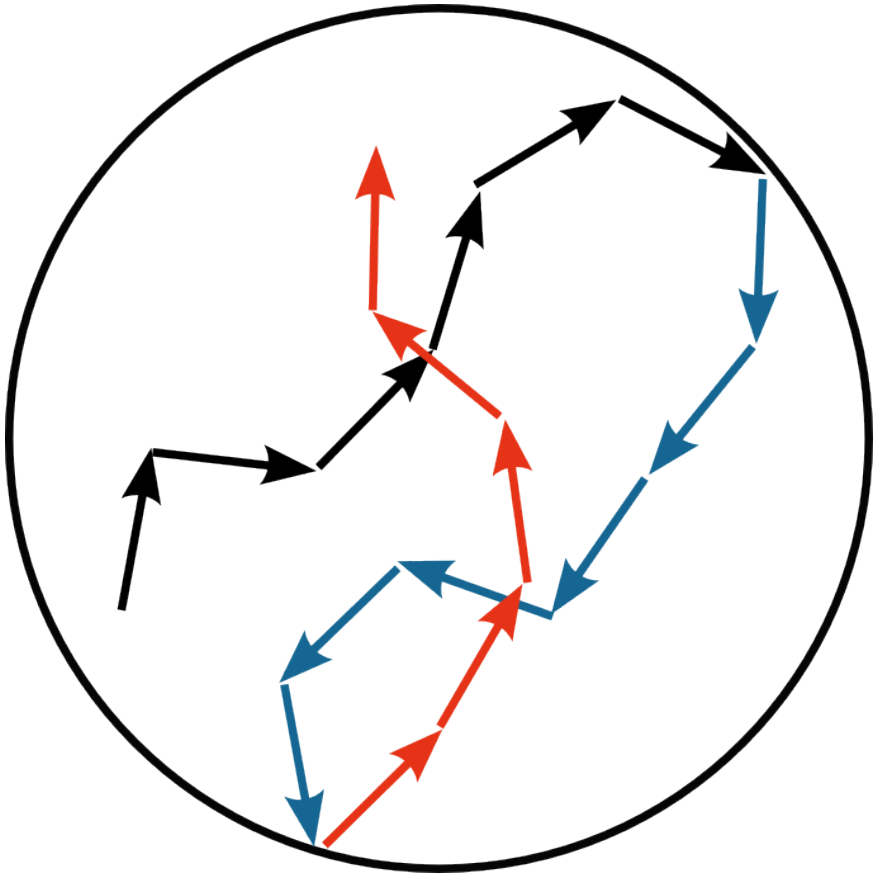


random walk
$R \sim b\, N^{1/2}$



self-avoiding walk
$R \sim b\, N^{3/5}$

Equilibrium globule is a conformation of a fully equilibrated confined polymer

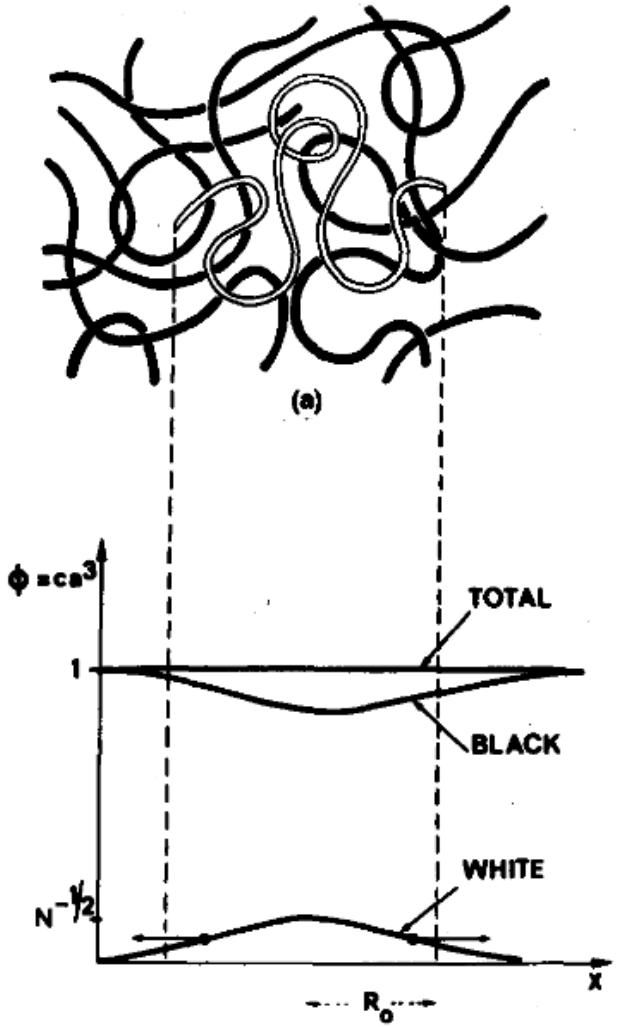


$R \sim b * s^x$, $s << (R_{max}/b)^{1/x}$

$R \sim R_{max}$, $s >> (R_{max}/b)^{1/x}$

$(R_{max}/b)^{1/x} \sim 1/100\ N$
for the largest chromosome

Chain in a melt or confinement is ideal (Flory theorem)



the concentration profile is flat across
the confining volume
=>
the excess of same-chain monomers is compensated by decreased concentration of monomers from the other chains
=>
chain has the ideal statistics,

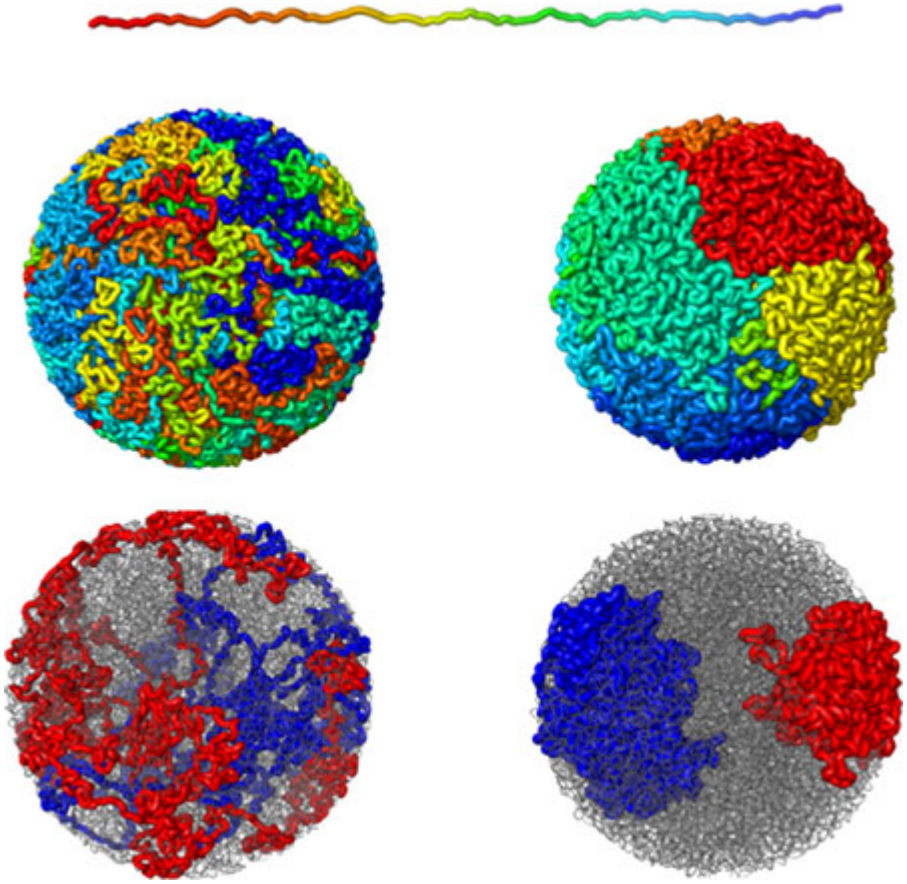
$R \sim b * s^{1/2}$, $s << N^*$

$R \sim const$, $s >> N^*$

from de Gennes, Scaling concepts in polymer physics, 1979

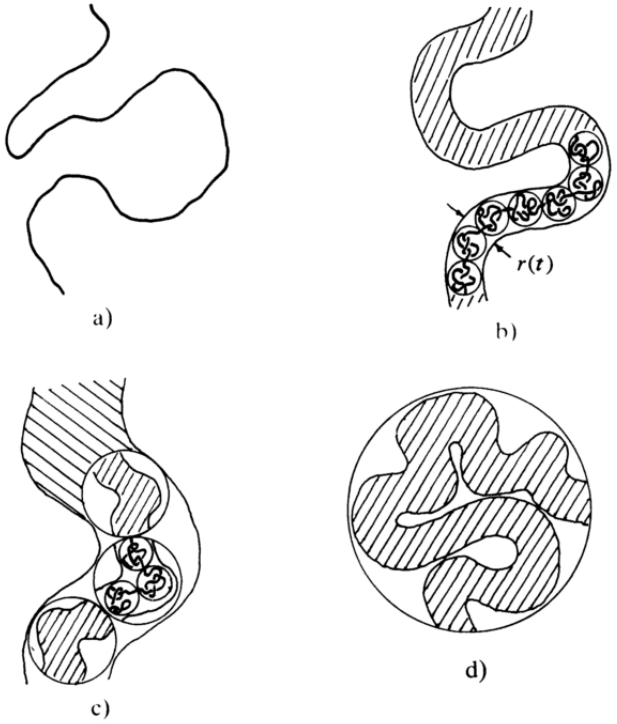
Second possible model of chromatin fiber folding

equilibrium globule fractal globule



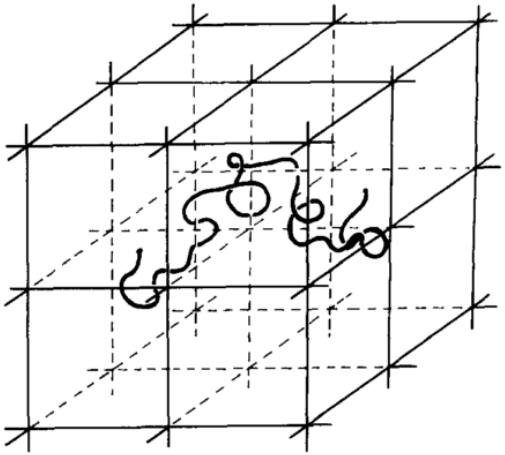
from L. Mirny, *Chromosome research,* vol. 19, no. 1, pp. 37–51, Jan. 2011.

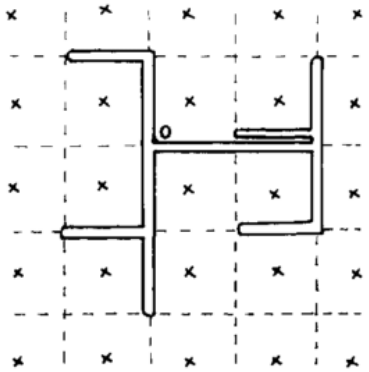
Crumpled (fractal) globule is a long-lived non-equilibrium state of a collapsed polymer

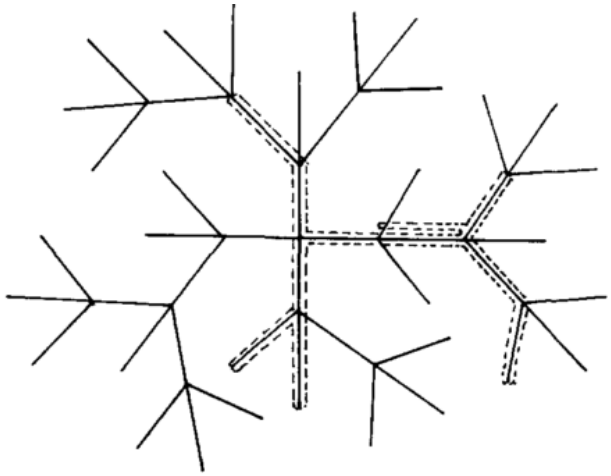


A. Y. Grosberg, S. K. Nechaev, and E. I. Shakhnovich, “The role of topological constraints in the kinetics of collapse of macromolecules,” *Journal de Physique*, vol. 49, no. 12, pp. 2095–2100, 1988.

Crumpled (fractal) globule is a space-filling fractal curve





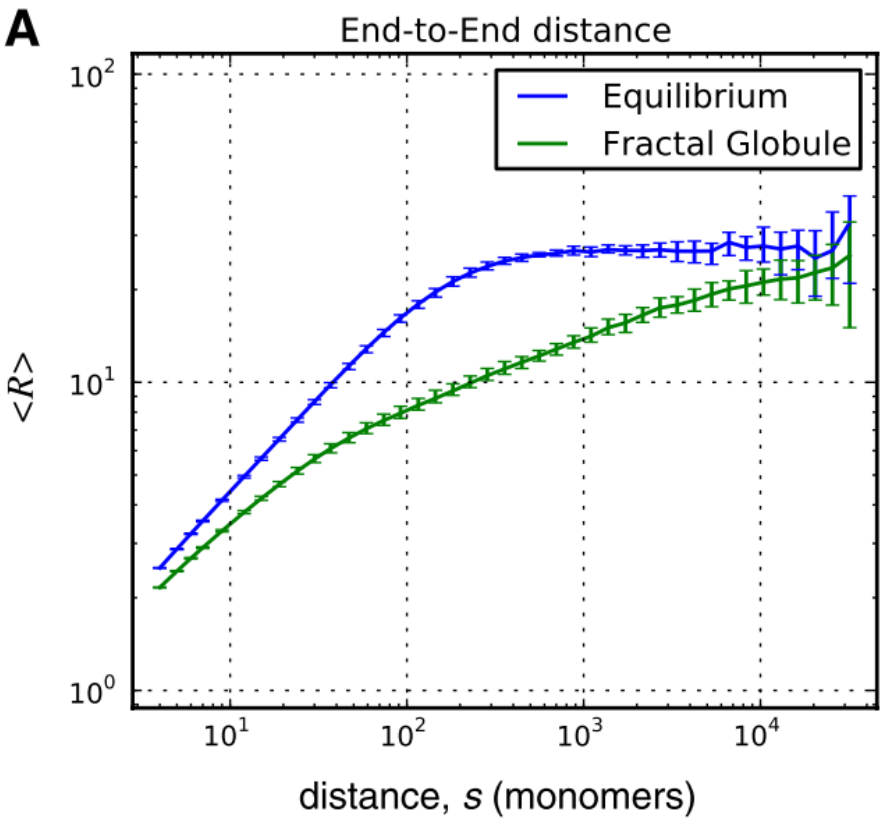


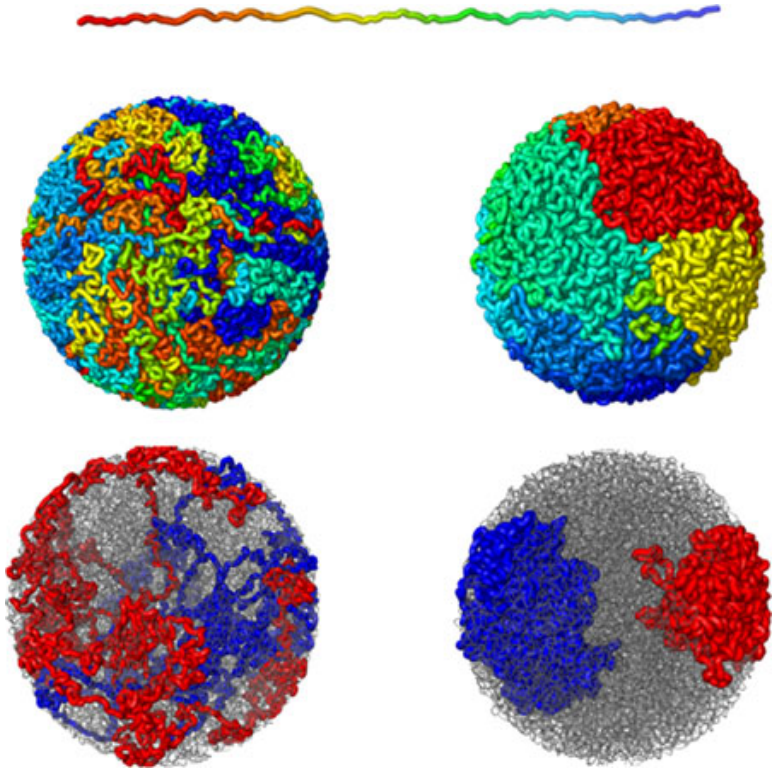
$R \sim a * i^{1/2}$, $i \sim s^{1/2}$, => $R \sim a * s^{1/4}$,
but $R > a * N^{1/3}$,

=>

$R \sim b * N^{1/3}$, does not plateu!

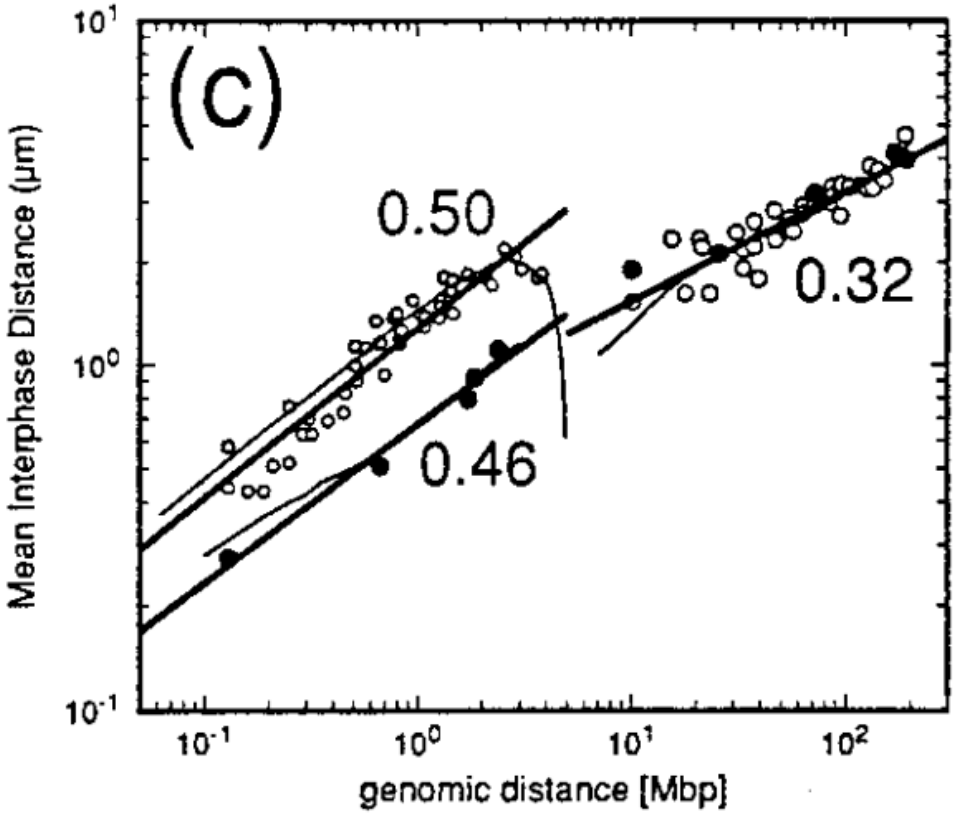
Equilibrium vs fractal globule





from L. Mirny, *Chromosome research,* vol. 19, no. 1, pp. 37–51, Jan. 2011.

Mean spatial separation measured by optical microscopy is consistent with the fractal globule model



C. Münkel, R. Eils, S. Dietzel, D. Zink, C. Mehring, G. Wedemann, T. Cremer, and J. Langowski, *Journal of molecular biology*, vol. 285, no. 3, pp. 1053–65, Jan. 1999.