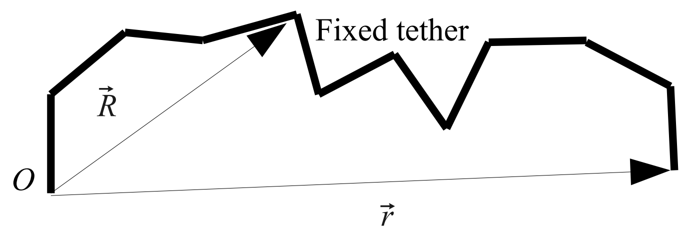
P847: Problems on random polymers: To be discussed in class on Sept 11.

1)
   a) For a 3D random ideal chain, convince yourself that the probability of observing the end to end distance $\vec{r}$ has to be $P(\vec{r})=(3/2\pi N a^2)^{3/2}\exp(-3r^2/2Na^2)$ given that the probability has to be normalized and that the variance has to be Na^2 .
   b) What is the distribution $P(r)$ and where is it peaked?

2) Tethering: Now consider that there is a tether between the beginning and the end of the polymer. What is the distribution $P(r)$ given that there is a tether at $\vec{R}$? There are N' Kuhn segments of length, a, between the tether and the end of the polymer.



3) Confinement: Solve/sketch the solution for the distribution of a confined 1D polymer that is tethered at x_0 . This involves solving the diffusion equation that we derived $\frac{\partial p(x,N)}{\partial N}=\frac{a^2}{2}\frac{\partial^2 p(x,N)}{\partial x^2}$ with the boundary conditions $p(0,N)=p(L,N)=0$ and $p(x,0)=\delta(x-x_0)$. Note this is not a probability until you normalize it to unity over the confining region.

4) Hi-C data: Looping probability: Calculate the probability of forming a loop in 3D where the end-to-end distance is within $r<\delta$. How does this scale with length of the polymer, L in 3D?