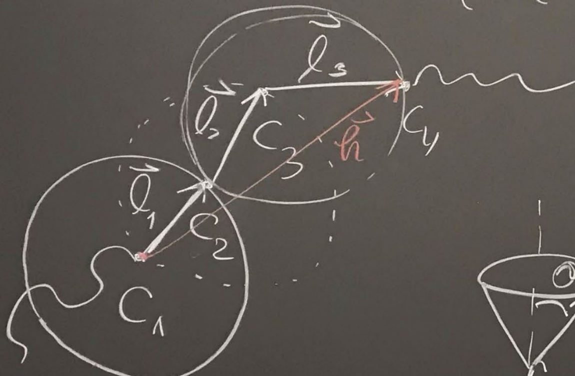
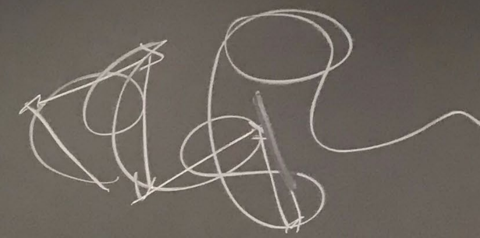
PE 280 000 g/mol

$M_0 = 28$ g/mol

perfect linear structure $L \sim 3\,\mu m$

collapsed coil ($\rho(PE) \simeq 0.9$ g/ml : $r \sim 50$ Å





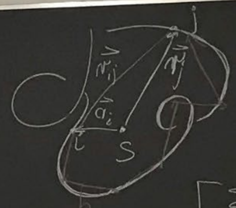
$$\vec{h} = \sum_{i=1}^{n} l_i \Rightarrow \overline{h^2} = \left\langle \sum_{i=1}^{n} \vec{l}_i \cdot \sum_{j=1}^{n} \vec{l}_j \right\rangle$$

$$= \underbrace{n l^2}_{\text{self-term}} + \underbrace{\sum_{i=1}^{n}\sum_{j=1}^{n} \langle \vec{l}_i \cdot \vec{l}_j \rangle}_{\text{cross term} \Rightarrow 0}$$

$$l_i \cdot l_{i-1} = l^2 \cos\theta$$

$$\langle \vec{l}_i \cdot \vec{l}_j \rangle = l^2 \langle \cos\theta \rangle = 0$$

$$\overline{h^2} = n l^2$$

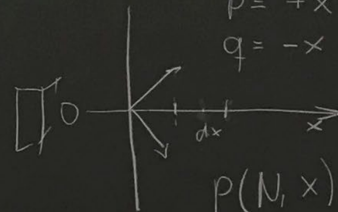


$\rightarrow \overline{h_0^2} = Nb^2$

$P(N,x) = \frac{1}{\sqrt{2\pi N b^2}} \exp\left(-\frac{x^2}{2Nb^2}\right)$

$r_g^2 = \frac{Nb^2}{6} = \frac{\overline{h^2}}{6}$

$R_g = \overline{S^2}^{1/2} = \left[\frac{\sum_{i=1}^{N} m_i \vec{r}_i}{\sum_{i=1}^{N} m_i}\right]^{1/2}$



$p = +x \quad N = p + q$

$q = -x \quad$ total distance $x = b(p+q)$

$P(N,x) = \left(\frac{1}{2}\right)^N N! \, \frac{2!}{(N+\frac{x}{b})!} \, \frac{2!}{(N-\frac{x}{b})}$

$R_g^2 = \frac{1}{2N^2} \sum_{i=1}^{N} \sum_{j=1}^{N} \langle \vec{r}_{ij}^{\,2} \rangle$

number of monomers

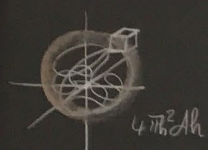
$\langle \vec{r}_{ij}^{\,2} \rangle = \underbrace{|i-j|}_{\text{number of links}} b^2$

- ln
- Stirling $\ln N! = N \ln N - N$
- Taylor series $\ln(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 + \ldots$

3-dim $P(N,\vec{h}) = P(\frac{N}{3},x)\,P(\frac{N}{3},y)\,P(\frac{N}{3},z)$

$|\vec{h}^2| = x^2 + y^2 + z^2$

$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} P(N,\vec{h})\,dx\,dy\,dz = 1$



$4\pi h^2 \Delta h$

$P(N,h)\,dh = 4\pi h^2 \left[\frac{3}{2\pi N b^2}\right]^{3/2} \exp\left(-\frac{3|\vec{h}^2|}{2Nb}\right) dh$

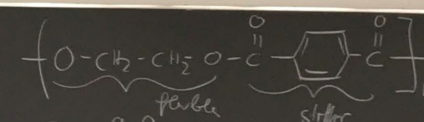
$\int_0^{\infty} P(N,\vec{h})\,dh = 1$

$\langle h^2 \rangle = \overline{h^2} = \int_0^{\infty} h^2 P(N,h)\,dh$

$= \int_0^{\infty} h^2 4\pi h^2 \left[\frac{3}{2\pi N b^2}\right]^{3/2} \exp\left(-\frac{3|\vec{h}^2|}{2Nb^2}\right) dh$

$\overline{h^2} = 4\pi \left[\frac{3}{2\pi N b^2}\right]^{3/2} \frac{3}{8} \left(\frac{3}{2Nb^2}\right)^{-2} \sqrt{\pi} \left(\frac{2Nb^2}{3}\right) = Nb^2$

	C_∞
PE	6.7
PS	10.2
DNA	600



$C_\infty = 9.0$

$a = l_p = 6.6\,\text{Å}$

$b = 13.2\,\text{Å}$

$$h^2 = 2aL - 2a^2\left(1 - \exp\left(-\frac{L}{a}\right)\right)$$

a) statistical coil $L \gg a$; $L_K = 2a$

$$\frac{L}{a} \gg 1 \quad \exp\left(-\frac{L}{a}\right) \to 0$$

$$h^2 = 2aL - 2a^2 = 2a(\underbrace{L-a}_{\approx L})$$

$$h^2 = 2aL$$

$$L_K = \frac{h^2}{L} = 2a = L_K$$

b) infinite stiff chain

$$h^2 = L^2$$

$$\exp\left(-\frac{L}{a}\right) = 1 - \frac{L}{a} + \frac{1}{2}\frac{L^2}{a^2} - \dots$$

$$h^2 = 2aL - 2a^2\left(1 - 1 + \frac{L}{a} - \frac{1}{2}\frac{L^2}{a^2}\right)$$

$$= 2aL - 2aL + L^2$$

$$h^2 = L^2$$

excluded volume