BE/APh 161: Physical Biology of the Cell, Winter 2023
Homework #6
Due at the start of lecture, 2:30PM, February 22, 2023.

Problem 6.1 (Diffusion along a polymer, 10 pts)**.**
Some proteins, such as polymerases, diffuse along DNA prior to finding their binding sites. If a protein diffuses along DNA, its root mean square displacement along the filament scales as $\sqrt{t}$. How does the root mean square displacement *in space* scale with time?

Problem 6.2 (The persistence length , 10 pts)**.**
In lecture, we defined the persistence length to be the length ξ_p such that

$$\langle \mathbf{u}(s) \cdot \mathbf{u}(s') \rangle = \mathrm{e}^{-|s'-s|/\xi_p}. \tag{6.1}$$

Show that it follows from this definition that the persistence length is

$$\xi_p = \lim_{L\to\infty} \langle \mathbf{R} \cdot \mathbf{u}_0 \rangle, \tag{6.2}$$

where $\mathbf{R}$ is the end-to-end distance of a polymer and $\mathbf{u}_0$ is the unit tangent at $s = 0$. Explain intuitively why this expression is the persistence length.

The remainder of this homework will be posted later this evening, Feb 15.