

## Homework 2

- 1) *S.cerevisiae* (baker's yeast) has 16 chromosomes which range in size from  $2.2 \times 10^5$ bp –  $1.5 \times 10^6$ bp. Assuming each nucleosome in *S.cerevisiae* binds 146bp of DNA with 50bp spaces between, how many nucleosomes could you fit on a  $5 \times 10^5$ bp strand? Look up the actual chromosome density and compare.
- 2) Knowing that 146bp wraps around each histone, and that the DNA wraps twice around a histone to make a nucleosome, estimate the volume of a histone. And a the volume of a nucleosome?
- 3) Recall the energy of looping DNA can be expressed as  $E_{Loop} = \frac{\pi Y I}{R}$  where R is the radius of the bend, Y is the Young's modulus and I is the geometric moment. The energy of looping can also be expressed in terms of persistence length  $E_{Loop} = \frac{L_p \pi k_B T}{R}$  where  $L_p$  is the persistence length of DNA. Using the persistence length of dsDNA, estimate the energy of looping DNA around a histone.
- 4) If a phage genome is  $5 \times 10^4$ bp, calculate the energy of packing it as concentric loops (like a coiled spring) into a spherical phage head ~50nm in diameter.