Problem Set 9 (**Due Nov 11th**)

1. Although the two processes are very similar on the chemical level, DNA replication is much more intricate than transcription. Why?

2. Name and discuss the role of all proteins that are important in DNA replication. For each of the enzymes, determine the class of reaction that they catalyze (note that you can always verify your answer by determining the EC number).

3. DNA polymerase structure/function. Use *Taq* Pol I (pdb id 3KTQ) and *E. coli* Pol I (1KLN) to answer these questions.
    a. Describe how Pol I selects the correct base pair. The *Taq* structure shows the appropriate conformation of the enzyme. You don't necessarily have to show an image; just understand what is important for bases selection.
    b. When the wrong base pair is added to the 3' end of the growing strand, how does Pol I sense this mistake and correct it. 1KLN shows Pol I with the growing strand in the 3'→5' exonuclease active site.

4. Newly synthesized dsDNA is arranged in the A-form just after it is made. Why is this important for DNA Polymerases?

5. In class, we discussed how DNA Ligase can use ATP as an energy source for the ligation reaction. Please draw a mechanism showing how this enzyme could use NADH to drive the ligation reaction. Note that some NADH dependent ligases use Tyr in place of the catalytic Lys in the ATP-dependent reaction. You may show the reaction using either amino acid as the nucleophile.

6. If you wanted to incorporate ^{32}P into a DNA strand, you could use the strategy shown below.
    a. Why is Pol I a better choice than Pol III?
    b. So as not to be wasteful, only one phosphorus in dNTPs needs to be isotopically enhanced. Which one and why?