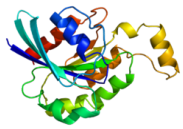
# Chem 331 Biochemistry

## Nucleotides

*Learning Objectives, Study Guides*



**Learning Objectives**

- Recognize the important chemical features of nucleotides, orientation and distinguish purines from pyrimidines. There are several critical atoms/roles for nucleotides.
- Know the mechanism for the formation of the phosphoester bond of DNA
- Understand the how the structure of DNA forms DNA into a helix and the forces that stabilize it
- Know the impact of tautomerization on potential DNA structure and interaction with proteins
- Explain the torsion angles with syn or anti position of bases/ribose and how non-watson crick bonding can take place
- Distinguish between the three forms of DNA and the forces that cause these to happen
- Explain the impact of base stacking on DNA helix formation and info on box on thermodynamics and DNA annealing – particularly the "nearest neighbor model".
- Know endopuckering from a structural approach and the impact on DNA form
- Describe hoogstein and other possible bonding, be able to identify non-typical WC bonding and explain the differences as well as if they could or couldn't exist in A B or Z DNA
- Define the difference between melting and stability of a double stranded DNA
- Explain the limited flexibility of DNA in terms of the torsional angles of DNA backbone
- Know the impact and importance of the orientation of purine and pyrimidine bases with respect to the ribose units on DNA structure
- Chemically explain how DNA is stabilized by base paring, stacking and ionic interactions
- Understand the basics of PCR and the factors that alter PCR effectiveness
- Outline and explain the chemistry of standard DNA sequencing and next generation sequencing
- Be able to know how PCR is used in other techniques and the science behind each.
- Explain how restriction enzymes function
- Be able to explain how to PCR or restriction enzyme clone/subclone a gene into a plasmid.
- Know the portions of a plasmid and how to tranfect or transform the DNA into a cell
- Explain in detail how to create site directed mutations and even deleation mutations.
- Understand the basics of Gibson Assembly cloning
- Know how the wobble hypothesis and tRNA can impact expression of one organism's gene in another organism (hint – rare codon).

**Study Notes from Dr P:** *There are three phases to this section. 1) Structure and the forces that stabilize DNA and RNA structure. 2) Functions of DNA and RNA and 3) Molecular techniques or manipulation of DNA. When you are studying the first phase, look at the structures and see how they impact how DNA and RNA come together. Think of the bonding and IMF. A common mistake is to fall back on the 2 vs 3 base pairing and not even look at the structure of the components that make DNA and RNA. Hoogstein bonding is new to you and while it isn't common, it highlights, like many other components of this chapter, how the structure brings about the stability and binding of nucleotides. The middle phase is fairly qualitative and while not in-depth, it is a way to put everyone on the same level of molecular biology. Like it? Awesome, take molecular techniques and molecular biology!!! More of this will be included in biochem II!!!. Really dig into the molecular manipulation section. PCR beyond the simple is key. I like you to know how things work, not describe how these techniques are used. Cloning, PCR, SDM are all important.*