BIO 184 - PAL Problem Set Lecture 1 (Brooker Chapter 9)
Molecular Structure of DNA and RNA

Section A. Identification of DNA as the genetic material

In the Griffith experiment, what is the difference between R cells and S cells?

What are the three different ways to introduce new genetic information into bacteria?

What is genetic transformation?

What does it mean when an organism is naturally transformable?

How does Griffith's experiment relate to the transformation experiment you did in lab?

If living R cells are mixed with heat-lysed S cells and then plated, what do you see on the plates? Why?

If Griffith had mixed heat-killed R cells with living S-cells and injected the mixture into his mice, what would have happened?

Why was Griffith's experiment seminal? Why/how did his experiment suggest that the genetic information molecule might *not* be a protein?

Assuming the experiment is performed using Avery, McLeod, and McCarty's general approach, which of the following mixtures would yield smooth colonies when plated?

1. **Lysed R cells mixed with living S cells**
2. **Lysed S cells mixed with living R cells**
3. **Lysed S cells mixed with living R cells + DNAase**
4. **Lysed S cells mixed with living R cells + protease**
5. **Lysed S cells mixed with living R cells + RNase**

If Avery, MacLeod, and McCarty had determined that the transforming molecule was a *protein*, what experimental results would have been observed in the five scenarios above?

Why did Avery, MacLeod, and McCarty use an antibody in their experiment?

Why was Avery, McLeod, and McCarty's experiment seminal? What was its conclusion in reference to identifying the genetic material?

In the Hershey and Chase experiment, how does T2 infect bacteria?

Does the phage enter its host cell?

****If phage labeled with radioactive phosphorous is allowed to infect bacterial cells, should newly synthesized phage be labeled?**

Why was the Hershey and Chase experiment so important? What was its conclusion?

Do all viruses contain DNA?

What types of macromolecules do retroviruses contain? How do this compare to the macromolecule components of other viruses?

Section B. Nucleic Acid Structure

Draw a nucleotide in as much detail as possible. Label the phosphate group, pentose sugar, and nitrogenous base. Label the carbon numbers (1', 2', 3', 4', & 5') on the pentose sugar.

What carbon number attaches the sugar to the nitrogenous base? The sugar to the phosphate group?

What carbon numbers links together individual nucleotides? What type of bond is this (what is the name)? How does this bond differ between DNA and RNA?

Does a stand of DNA or RNA have direction? Explain.

What is the difference between the pentose sugar between DNA and RNA?

List all the pyrimidines used in DNA and RNA.

List all the purines used in DNA and RNA.

Section C. Watson and Crick's discovery of the double-helix DNA structure.

What other scientists provided the framework for Watson and Crick's discovery of the DNA double helix?

Who was Rosalind Franklin and how did she contribute to Watson and Crick's work? What were the conclusions from her work regarding the DNA structure?

What is Chargaff's rule?

The soil-dwelling Gram-positive bacterium Streptomyces coelicolor has a genome containing 35% guanine. What is it's percentage thymine?

According to Chargaff's rule, which is true or false?

a) **the molar amounts of pyrimidines in DNA is roughly equal to the molar amount of purines**

b) **the molar amounts of T nucleotides in DNA is equal to the molar amount of A nucleotides**

c) **an organism can have roughly equal molar amounts of A, T, C, and G nucleotides in their DNA**

What are the implications of Chargaff's rule to the DNA double-helix structure?

One strand of DNA is 5' - AGTCCTGA - 3'. What is the opposite strand?

In solving the structure of DNA, Watson and Crick actively used what technique?

Section D. DNA packaging in the cell

In eukaryotes, how is DNA packaged inside the cell?

How does DNA wrap around histones?

During what cell cycle stage represents the highest level of chromosome condensation? What stage represents the lowest level of chromosome condensation?

How does the three-dimensional folding and structure of a chromosome compare to the structure of double-stranded DNA?

Section E. RNA structure

List three key structural differences between DNA and RNA

Can uracil base pair with another base? Is so, which one(s)? How many hydrogen bonds form?

What are some of the different secondary structures of RNA and DNA?

What are hairpin loops?

Why is RNA more prone than DNA to forming secondary structures?

Do RNA &/or DNA have enzymatic activity?