Molecular Genetics (9%)

I. **DNA**
   a. Genetic material
   b. Double Stranded
   c. Bases
      i. 4 types
         1. Adenine
         2. Thymine
         3. Guanine
         4. Cytosine
      ii. Connected by Hydrogen Bonds
         1. Adenine – Thymine: 2 Hydrogen Bonds
         2. Guanine – Cytosine: 3 Hydrogen Bonds
         3. To Unzip DNA: Break Hydrogen Bonds between bases
   d. Experiments (Pg. 167)
      i. Griffith's Experiment
         1. Gave mouse 2 kinds of bacteria
            a. Bad + Mouse → Dead
            b. Good + Mouse → Alive
            c. Bad + <u>Heat</u> + Mouse → Alive
            d. Bad + <u>Heat</u> + Good + Mouse → Dead
         2. Result/Conclusion: DNA of bad bacteria causes good bacteria to produce bad bacteria
      ii. Hershey-Chase Experiment
         1. Infected bacteria with a bacteriophage
            a. All the bacteria were radioactive
            b. Bacteriophage: Virus that specifically kills bacteria
            c. Blended bacteria and bacteriophages
               i. Separated infected bacteria and bacteriophages
            d. Virus began replicating in bacteria
            e. New bacteriophages had radioactive DNA but not radioactive proteins
         2. Result/Conclusion: DNA was the genetic material – not the proteins

II. DNA Replication

- a. S Phase
  - i. DNA Helicase (enzyme)
    1. Unzips strands
    2. Breaks Hydrogen Bonds
  - ii. RNA Primase (enzyme)
    1. Creates RNA Primer
  - iii. DNA Polymerase III (enzyme)
    1. Builds new strand of DNA in a 5′ – 3′ direction
       - a. Leading Strand
         - i. Single stretch
       - b. Lagging Strand
         - i. Okazaki fragments
  - iv. DNA Ligase (enzyme)
    1. Links Okazaki fragments together

III. Protein Synthesis

- a. Creation of Proteins using DNA Code
- b. Transcription
  - i. RNA Polymerase (enzyme)
    1. Transcribes a gene to make single stranded mRNA
- c. Translation
  - i. mRNA
    1. Translated into a protein
    2. Carry codons
    3. Eukaryotic Cells
       - a. RNA Processing
         - i. Before mRNA leaves the nucleus
           1. Introns and Exons
              - a. Introns are spliced out
              - b. Exons are expressed
    4. Ribosome
       - a. P-Site
         - i. Start codon: AUG: MET
       - b. A-Site
         - i. 2nd codon "waits"
       - c. Peptide bonds connect codons between sites
       - d. Ribosome moves
       - e. tRNA leaves
       - f. A-site codon + tRNA moves to P-site

g. A-site open again

ii. tRNA
1. Transfer RNA
2. Carry amino acids (anti-codons)
3. Match Codons to Anti-codons

iii. Chain of amino acids form to create a protein

d. Operons
i. Regulate Protein Synthesis
ii. Can be turned On and Off
1. Promoter
a. Where RNA Polymerase Binds
2. Operator
a. Turns on the Operon
3. Regulatory Gene
a. Produces a Regulatory Protein
i. Binds to the Operator

IV. Genetic Engineering

a. DNA can be cut using **Restriction Enzymes**
b. Plasmids can be cut using **Restriction Enzymes**
c. New genes can be inserted into the **Plasmid**
d. New **Plasmid** can be inserted into the **Bacteria**
e. **Bacteria** will produce new genes

V. Viruses

a. Bacteriophages
i. Viruses that infect Bacteria
1. Litic Cycle
a. Viral DNA is transcribed into Bacteria
b. Bacteria create mini Viruses
c. Viruses break open the Bacteria and go on to infect more Bacteria
d. Bacteria die
2. Lysogenic Cycle
a. Viral DNA is transcribed into Bacteria
b. Viral DNA is in the chromosome of Bacteria
c. Bacteria remain dormant
d. No harm – yet