I. History of DNA

II. Griffith Discovers “Transformation”
   • Attempting to develop a vaccine for pneumonia
   • Isolated two strains of *Streptococcus pneumoniae*

III. Bacterial Transformation
   • Conclusion:

IV. What is the Hereditary Material?
   • Inherited traits are diverse - all features of the structure and function of all organisms!
   • The molecules encoding traits must be diverse in structure
   • The hereditary material is likely protein

V. Bacteriophages
   • Viruses that infect bacteria
   • Consist of protein coat and DNA inside
   • Hypothesis:

VI. Hershey & Chase’s Experiments
   • Labeled bacteriophages with:
     – Radioactive sulfur that is incorporated into DNA
     – Radioactive phosphorus that is incorporated into protein
   • Allowed labeled viruses to infect bacteria
   • Hypothesis:
VIII. Rosalind Franklin’s Contribution

IX. Watson-Crick Model
- Molecule is a double helix
- DNA consists of two
- Strands are held together by
- Base Pairs:

X. Structure of Nucleotides in DNA
- Each nucleotide consists of:
- Four bases:

XI. The Nature of DNA Structure Helps Explain How it Replicates
- DNA is two nucleotide strands held together by hydrogen bonds
- Hydrogen bonds between two strands are easily broken
- Hypothesis: Each strand serves as template for new strand

XII. DNA Replication

XIII. From DNA to Proteins

XIV. Steps in Protein Synthesis
1) DNA is transcribed to form RNA
   - Occurs in the nucleus
   - RNA moves into cytoplasm
2) RNA is translated to form polypeptide chains, which fold to form functional proteins

XV. Overview of Protein Synthesis

XVI. Transcription of Different Portions of DNA
- Messenger RNA (mRNA) =
- Ribosomal RNA (rRNA) =
- Transfer RNA (tRNA) =

XVIII. Part I: Transcription
- DNA is a template for the synthesis of a new RNA molecule with complementary base pairs.
- As in DNA, C pairs with G
- BUT, in RNA Uracil (U) pairs with adenine (A). There is no T in RNA.

XVIII. Part II: Translation
- Codon = a linear series of three nucleotide bases on mature mRNA (triplet)
- Genetic Code = Codes for 64 different base triplets. 61 specify amino acids and 3 “say” stop.
- Anti-Codon = linear series of three nucleotide bases on a molecule of tRNA, carries an amino acid
XIX. The Genetic Code Is Redundant
• ONLY twenty amino acids
• Most amino acids can be specified by

XX. Three Stages of Translation
• Initiation
  • Initiator tRNA binds to small ribosomal subunit
  • Small subunit/tRNA complex attaches to mRNA and moves along it to an AUG “start” codon
  • Large ribosomal subunit joins complex
• Polypeptide Elongation
  • mRNA transcript passes through ribosomal subunits
  • tRNAs deliver amino acids to the ribosomal binding site in
  • Enzymes form peptide bonds between the amino acids and the polypeptide chain grows
• Termination
  • A “stop codon” in the mRNA moves onto the ribosomal binding site
  • This causes proteins called release factors to bind to the ribosome.
  • mRNA and newly formed polypeptide are released

XXI. Mutations May Alter the Products of Transcription and Translation
  – Base-Pair Substitutions
  – Frame Shift Mutations
    • Insertion
    • Deletions

XXII. Frameshift Mutations
• Insertion - Base(s) added into DNA
  CAT, AND, THE, HAT ==> 
• Deletion - Base(s) removed from DNA
  CAT, AND, THE, HAT ==> 
  – Both shift the
  – Result in change in codons in mRNA and thus the amino acid sequence in the gene product
  – Mutation may be

XXIII. Transposable Elements - Jumping Genes
• Discovered in corn by Dr. Barbara McClintock who was awarded the Nobel Prize for her work
• TEs = DNA segments that move spontaneously about the genome - a form of mutation
• When they insert into a gene region, they usually

XXIV. Mutation Rates
• Mutations are generally corrected by proofreading enzymes during
• Each gene has a characteristic mutation rate
• Average rate for mutation in eukaryotes is between
• Only mutations that arise in germ cells

XXV. Alternate Splicing