

AP Biology Pre-Discussion Questions: Information 2- Central Dogma

Instructions:

Topic Presentation:

Textbook Reading:

Principles of Life:

OpenStax Biology:

Biozone Pages:

Supplementary Resources:

“Crash Course: Biology” Videos:

Videos By Paul Andersen:

Part 1: DNA Replication

Questions to answer:

Things you should make sure you understand:

Part 2: Transcription

Questions to answer:

Things you should make sure you understand:

Part 3: Translation

Questions to answer:

Things you should make sure you understand:

Instructions:

- Open the presentation.
- Interact with it. Take notes as you wish.
- Self-Quiz 1: Answer the “Questions to answer”.
- Self- Quiz 2: Make sure you understand the “Things you should make sure you understand”.
- Feel free to view the “Supplementary Resources”.
- Write down any other questions that you have about the material.

Topic Presentation:

[click here](#)

Note: This is a 3-part presentation

Textbook Reading:

Principles of Life:

- Part 1: Chapter 9 (section 9.2)
- Part 2: Chapter 10 (section 10.1, 10.2)

- Part 3: Chapter 9 (section 9.3), chapter 10 (section 10.3, 10.4, 10.5)

OpenStax Biology:

- Part 1: Chapter 14- Sections 14.3 - 14.6
- Part 2: Chapter 15- Sections 15.1 - 15.4
- Part 3: Chapter 15- Section 15.6

Biozone Pages:

Volume 1:

- Part 1: pp. 105-111
- Part 2: pp. 115-116
- Part 3: pp. 112-114, 117-121

Supplementary Resources:

“Crash Course: Biology” Videos:

[DNA Structure & Replication: Biology #10](#)

[DNA, Hot Pockets, & The Longest Word Ever: Biology #11](#)

Videos By Paul Andersen:

[“DNA & RNA Part 2”](#)

[“DNA Replication”](#)

[“Transcription & Translation”](#)

[“The Central Dogma”](#)

[“Genotypes and Phenotypes”](#)

Part 1: DNA Replication

Questions to answer:

1. Diagram the “Central Dogma” of molecular genetics. How does it allow for DNA to serve as both the heritable molecule and code for protein sequence?
2. Explain the experiment conducted by Meselson and Stahl. How did the results of their experiment demonstrate the semi-conservative model of DNA replication was the accurate model?

3. Explain how each of the following enzymes contributes to the process of DNA replication:
 - a. helicase
 - b. single-stranded binding proteins
 - c. DNA polymerase
 - d. primase
 - e. ligase
 - f. Topoisomerase/gyrase
4. How does replication of the leading strand differ from replication of the lagging strand? Why can't both strands of DNA be replicated in the same fashion?
5. Diagram the replication fork. Include:
 - a. the leading strand
 - b. the lagging strand
 - c. prime orientation of both parent strand and both daughter strands.
 - d. Replisome
 - e. Okazaki fragments
6. Why is telomerase necessary during the replication of eukaryotic chromosomes?

Things you should make sure you understand:

(feel free to ask questions about them in class)

- How to recognize the 5' and 3' ends of a DNA strand.
 - The structural differences between free nucleotides (nucleoside tri-phosphates), and nucleotides in a nucleic acid.
 - Why replication is necessary for cells, where it happens, its inputs and its outputs.
 - The specific details of the process of replication.
 - The mechanisms in replication that reduce the error rate.
 - The major differences in replication between prokaryotes and eukaryotes.
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Part 2: Transcription

Questions to answer:

1. How did Beadle and Tatum's work on auxotrophs suggest that metabolism was controlled by protein enzymes?
2. How does RNA polymerase identify where to begin transcription of a gene?
3. Explain the relationship between the promoter, enhancers, and transcription factors.

4. Diagram each of the following phases of transcription.
 - a. initiation
 - b. elongation
 - c. termination
5. Explain what happens during each of the following post-transcriptional modifications of eukaryotic transcripts:
 - a. splicing
 - b. 5' capping
 - c. poly adenylation.
6. How do eukaryotic cells utilize alternative splicing to maximize variety of gene products that they can produce?

Things you should make sure you understand:

(feel free to ask questions about them in class)

- The relationship between DNA, RNA, Protein, Cells and the Organism.
 - Why transcription is necessary for cells, where it happens, its inputs and its outputs.
 - The major structural differences between RNA and DNA.
 - The specific details of the process of transcription.
 - The major differences in transcription between prokaryotes and eukaryotes.
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Part 3: Translation

Questions to answer:

1. Explain the meaning of this statement: "The genetic code is punctuated, unambiguous, and redundant."
2. How does the structure of a tRNA molecules enable its function?
3. How does the structure of a ribosome enable its function?
4. Diagram what happens during each of the following phases of translation. Include the location (A, P, or E site) of incoming tRNA molecules, incoming amino acids, the growing polypeptide chain, uncharged tRNA molecules and release factors as appropriate:
 - a. initiation
 - b. elongation
 - c. termination

5. Diagram a complete eukaryotic transcription unit. Define each part.
6. Explain the effect that point mutations and frameshift mutations can have on gene products. Make sure to differentiate between:
 - a. neutral (silent) mutations
 - b. missense mutations
 - c. nonsense mutations
 - d. Why insertion/deletion of three bases is less deleterious than insertion/deletion of one or two bases.

Things you should make sure you understand:

(feel free to ask questions about them in class)

- How mRNA sequence dictates protein sequence.
- Why translation is necessary for cells, where it happens, its inputs and its outputs.
- How amino acids are associated and disassociated from tRNA molecules.
- The major differences in translation between prokaryotes and eukaryotes.
- How and why the meaning of the term “gene” has changed over the past 100 years.