

DNA STRUCTURE & REPLICATION LESSON

Big Ideas:

- **Central Dogma of Biology – DNA is the code or “blueprint” for making proteins, which are responsible for the production of inherited traits.**
- **DNA must replicate or copy itself faithfully in order to pass all genetic information on to descendent cells, including sex cells.**

Established Goals:

- **The students will be able to describe/show the structure and function of DNA (B4.2C). BASIC**
- **The students will be able to describe/show the process of DNA replication (B4.2g). INTERMEDIATE**
- **The students will be able to list, show, and explain the functions of the enzymes involved in DNA replication. ADVANCED**

Materials:

2 Pieces - Red Licorice = “Old” Strands of DNA

2 Pieces - Black Licorice = “New” Strands of DNA

8 - Gum Drops (4 Different Colors; 2 of Each Color) = Nitrogen Bases

Ex. 2 Red, 2 White, 2 Yellow, 2 Green

Toothpicks (Minimum of 8) = Bonds

Paper Towels = Clean Surface to Set Your Candy On

Understandings:

The students will understand that...

1. DNA has a double-helix, or twisted ladder shape.
2. DNA is double-stranded.
3. DNA has a sugar (deoxyribose)-phosphate backbone
4. DNA contains four nitrogen bases: adenine (A), guanine (G), cytosine (C), thymine (T).
5. The nitrogen bases of DNA are paired together by hydrogen bonds.
6. Adenine pairs with thymine. Guanine pairs with cytosine.
7. DNA is a series of repeating nucleotides.
8. A nucleotide is composed of a simple sugar (deoxyribose), a nitrogen base, and a phosphate group.
9. DNA is the code or “blueprint” for making proteins, which are responsible for the production of inherited trait.
10. DNA replication requires the enzymes helicase, DNA polymerase, and DNA ligase.
11. Helicase is the “scissors” that unwinds the DNA by breaking hydrogen bonds between the nitrogen bases that hold the two strands of DNA together.
12. Each “old” strand of DNA serves as a template for the formation of a “new” strand.
13. DNA polymerase is the “match maker” that pairs free nucleotides from the nucleus with the recently unpaired nitrogen bases of the “old” DNA strands.
14. DNA ligase is the “glue” that seals the gaps between the nucleotides that will make up the “new” DNA strands.
15. DNA replication produces two identical DNA molecules from one DNA molecule via semi-conservative replication.

Essential Questions:

BASIC:

1. What does DNA stand for? _____
2. Is DNA an acid or a base? _____
3. What is the shape of DNA? _____
4. What is the simple sugar in DNA? _____
5. What is the other component other than the simple sugar in the DNA backbone? _____
6. Where are the nitrogen bases in DNA located? _____
7. Name the four nitrogen bases in DNA and provide their symbols?

8. Which nitrogen bases pair together? _____ is to _____
as _____ is to _____
9. Which 3 components make up a nucleotide?

10. DNA is the code or "blueprint" for making _____.

INTERMEDIATE:

11. List the enzymes involved in DNA replication.

12. Match up the name of the enzyme with it's function in DNA replication.

(1) ___ DNA Ligase	A. Scissors
(2) ___ Helicase	B. Matchmaker
(3) ___ DNA Polymerase	C. Glue
13. Describe the function of helicase in a few sentences using all of the following words: unwinds, hydrogen bonds, nitrogen bases.

14. Describe the function of DNA Polymerase in a few sentences using all of the following words: free nucleotides from the nucleus, complementary base pairing, “new” DNA strand.

15. Describe the function of ligase in a few sentences using all of the following words: seal, nucleotides, “new” DNA strand.

ADVANCED:

16. When during the cell cycle does DNA replication happen?

17. Sketch both cell division cycles (mitosis and meiosis) for a diploid cell ($2n = 4$) and illustrate when DNA replication occurs and the final products of each cell division. HINT: Remember “I Promised Mother A Toad.”

Mitosis

Meiosis