

Name:

Date:

Period:

Biology: DNA

Discovering DNA Structure

Introduction: What does DNA look like at the molecular level? What's inside each DNA molecule? In this activity, you'll discover the answers to these questions. In addition, you'll learn about DNA replication. As you know, cells in our body die constantly, such as the skin cells. In order for us to replenish those cells, DNA replication has to occur. The first part of this activity will be done as a class and the second part will be done in groups.

Purpose: To determine the composition of a DNA molecule and to learn about DNA replication.

I. Class Activity with teacher DNA manipulative:

Activity A: What is a nucleotide?

1. What are the *three parts* in your nucleotide?
2. What *two parts* do all of the nucleotides have in common?
3. What is the *ONE* part of a nucleotide that is *DIFFERENT* among the nucleotides?
4. List the *four* different kinds of nitrogen bases in letters.

Activity B: What is a DNA molecule?

1. Now your teacher will show you a DNA molecule using the manipulative. Explain in your words what the DNA molecule looks like.
2. Which *two parts* of the nucleotide molecule are connected to each other?
3. What is the pairing arrangement of the nitrogen bases? This kind of pairing is called **complementary**. The attraction between two nitrogen bases is called **base pairing**.

_____ pairs with _____

_____ pairs with _____

Scientists abbreviate the nitrogen bases by using the **first letter** of each base. So

...

Base _____ stands for adenine

Base _____ stands for thymine

Base _____ stands for guanine

Base _____ stands for cytosine

4. In our cells, DNA molecules are composed of a chain of THOUSANDS of these nucleotides. For simplicity, this DNA molecule is only _____ nucleotides long.
5. Below, write down the order of the sequence of the bases in your group's DNA molecule. Use the letters: A, T, G and C. By convention, scientists usually write the sequence from *left to right*, if you place the chain of nucleotides in a *horizontal* position.
6. Is there an EQUAL number of Base A (adenine) and Base T (thymine) nucleotides in a DNA molecule? Why?
6. Is there an EQUAL number of Base G (guanine) and Base C (cytosine) nucleotides in a DNA molecule? Why?
7. The sides of the DNA strand are made up of alternating _____ and _____.

Now that you understand the basic structure of the DNA molecule it's time to get replicated!

II. Group Activity: DNA Replication

Activity C: How does DNA replicate?

Each group should have the following before getting started:

- 4 DNA "sense" strands (each strand has a number on the top (#1-#4))
- 6 Blank DNA strands
- 1 Dry Erase Marker (double check that you have the correct type!)

Create a DNA molecule

1. Choose two DNA sense strands to work from. Each pair of students should have a different numbered DNA sense strand in front of him or her.
2. Take the DNA sense strand and create the complementary strand by using the base pairing rules on the blank DNA strand.
3. Write your DNA sequence below and include the number that is on your DNA sense strand (remember a DNA molecule has two sides, so your sequence should too!).

When you're finished have your instructor check your work before moving on!

DNA Replication

1. With the Dry Erase marker label the DNA "sense" strand as ***Parental Strand 1***; label the once blank DNA strand as ***Parental Strand 2***.
2. Separate the two strands of DNA on the table.
3. Now each pair of students will work individually. One member will work with ***Parental Strand 1***; The other member will work with ***Parental Strand 2***.
Did you work with Parental Strand 1 or 2?
4. Using a new blank DNA strand create the appropriate base pairs to your Parental Strand.
5. The new strand of the two nucleotides you just joined together is called a **COMPLEMENTARY** copy of your Parental Strand. Write ***Daughter Strand #1*** on the strand that was base-paired to ***Parental Strand #1***. Write ***Daughter Strand #2*** on the strand that was base-paired to ***Parental strand #2***.
6. In the space below, write the sequence of your nucleotides in each strand.

Parental strand:

Daughter strand:

7. Looking at your double stranded DNA molecule, answer the following questions:
 - a. Are there still an EQUAL number of Base A and Base T nucleotides in a DNA molecule?
 - b. Are there still an EQUAL number of Base G and Base C nucleotides in a DNA molecule?
8. Compare your double stranded DNA molecule with the one from the other two students in your table. Did they replicate correctly? Make sure to check the base pairs carefully!
9. Compare ***Daughter Strand #1*** with ***Parental Strand #2***. Are the sequences the same or different?
10. Compare ***Daughter Strand #2*** with ***Parental Strand #1***. Are the sequences the same or different?

As you can see, you have successfully replicated the parental DNA. This mode of replication is called **semiconservative** replication because each parental strand is used as a model (or template) for the generation of the new daughter (or complementary) strand.

Conclusion: In your OWN words explain the steps needed for DNA replication to occur.

Short Quiz

1. What are the three parts in a nucleotide?
2. True or False: Each double stranded DNA has equal number of Base A and T nucleotides and the same number of Base G and C nucleotides.
3. Fill in the blank, the daughter strand of DNA is a _____ copy of the parental strand of DNA.
4. Use the base-pairing rule, write the complementary strand for the following DNA strand:

DNA strand: A-C-C-G-T

Complementary Strand: