# Week 11

## BIO-1305 - Biology 1 – Campbell Textbook

**Hello and welcome to the weekly resources for BIO-1305 - Biology 1 – Campbell Textbook!**

**This week is <u>Week 11</u> of class, and typically in this week of the semester, your professors are covering the topics below.** If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

**If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel, or any tutoring services we offer, please visit our website [www.baylor.edu/tutoring](http://www.baylor.edu/tutoring) or call our drop in center during open business hours (M-Th 9am-8pm on class days at 254-710-4135).**

**Keywords: DNA Structure, Nucleotides, Base Pairing, Semiconservative Replication**

### <u>Topic of the Week: Basic Structure of DNA</u>

**DNA** is the *genetic material* that contains all of the information about an individual. The structure of DNA is fascinating!

- DNA is a **polymer of nucleotides**
- Each nucleotide contains a nitrogenous base, pentose deoxyribose sugar, and phosphate group
- A molecule of DNA is structured in a **double helix**
- The strands in a molecule of DNA run **antiparallel**
    - This means that they run in *opposite directions*
- There are <u>four types</u> of nitrogenous bases: **adenine, guanine, thymine, and cytosine (abbreviated A, G, T, and C)**
    - Adenine in one strand will pair with thymine in another strand through *2 hydrogen bonds*
    - Guanine in one strand will pair with cytosine in another strand through *3 hydrogen bonds*

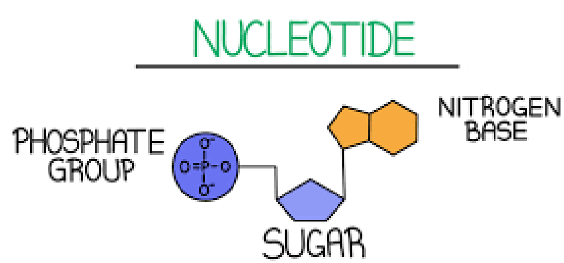
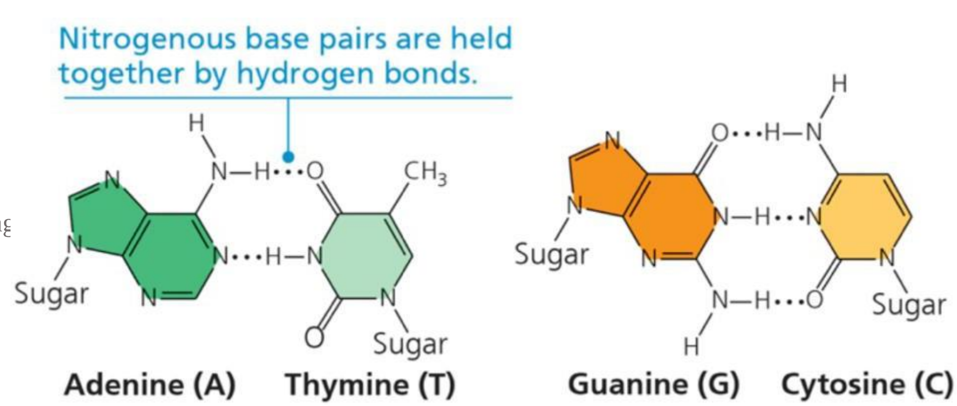



Photo taken from: https://www.expii.com/t/dna-structure-overview-diagrams-10209



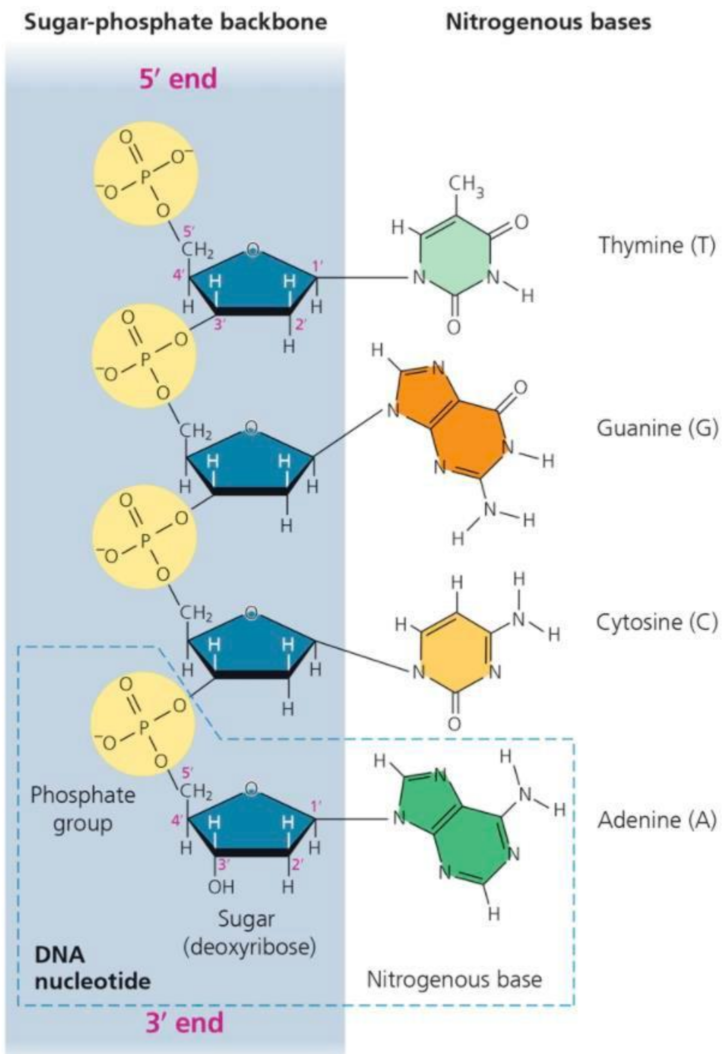

All diag ... on, unless

**Highlight #1: Structure of One STRAND**

Here is a great diagram of what **a portion of one DNA strand** will look like:

Things to note about this photo:

1. Notice how the 5' end and the 3' end are on opposite sides. This terminology refers to the *phosphate group* being attached to the **5' carbon** of the sugar of the top nucleotide.
2. Notice how the *phosphate groups* are on the outside of the strand and that they have a **negative charge**. This will be important later in DNA packaging.
3. Notice the structure of the nucleotides and how they stack. The nitrogenous bases are on the inside of the strand so they will be able to **pair** with their complementary nitrogenous base on another strand to form a complete DNA molecule.



## Highlight #2: Structure of One MOLECULE

Here is a diagram of what a portion of **a complete DNA molecul**e looks like:

Things to note about this photo:

1. Notice how the bases pair in the inside of the molecule.
2. Notice how the backbone of the molecule is called a **sugar-phosphate backbone.** This is because the phosphate and the sugar are found on the outside of the molecule.
3. Notice how this completed strand is actually in the form of **a double helix**!

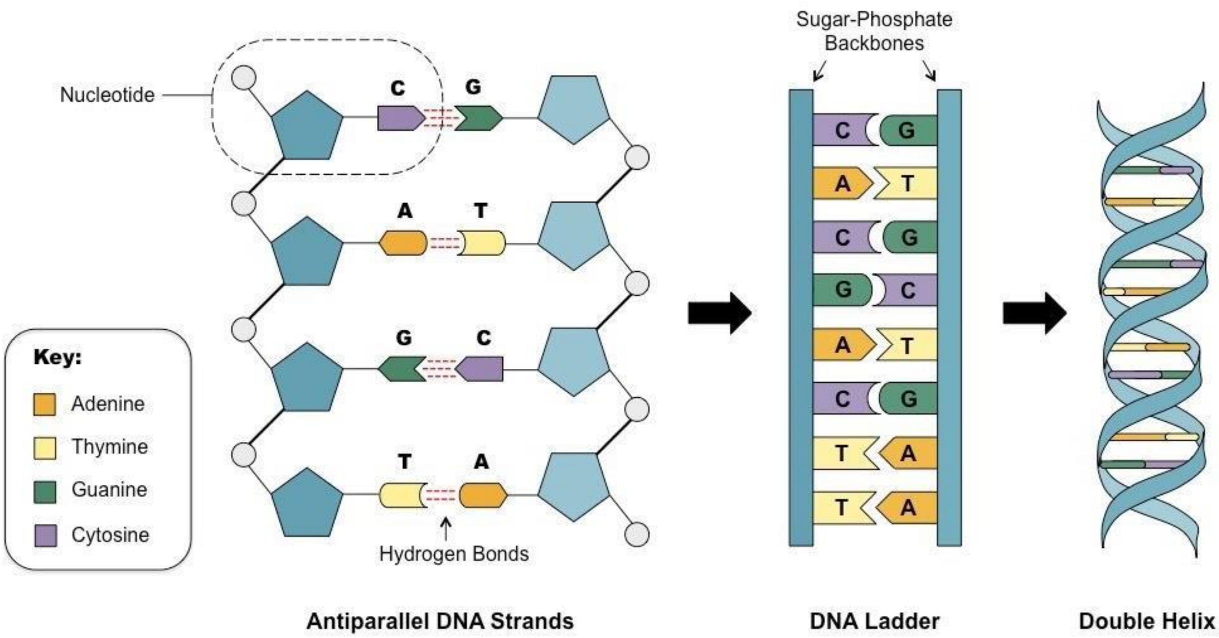



Photo taken from: https://ib.bioninja.com.au/standard-level/topic-2-molecular-biology/26-structure-of-dna-and-rna/dna-structure.html

## Highlight #3: Models of Replication

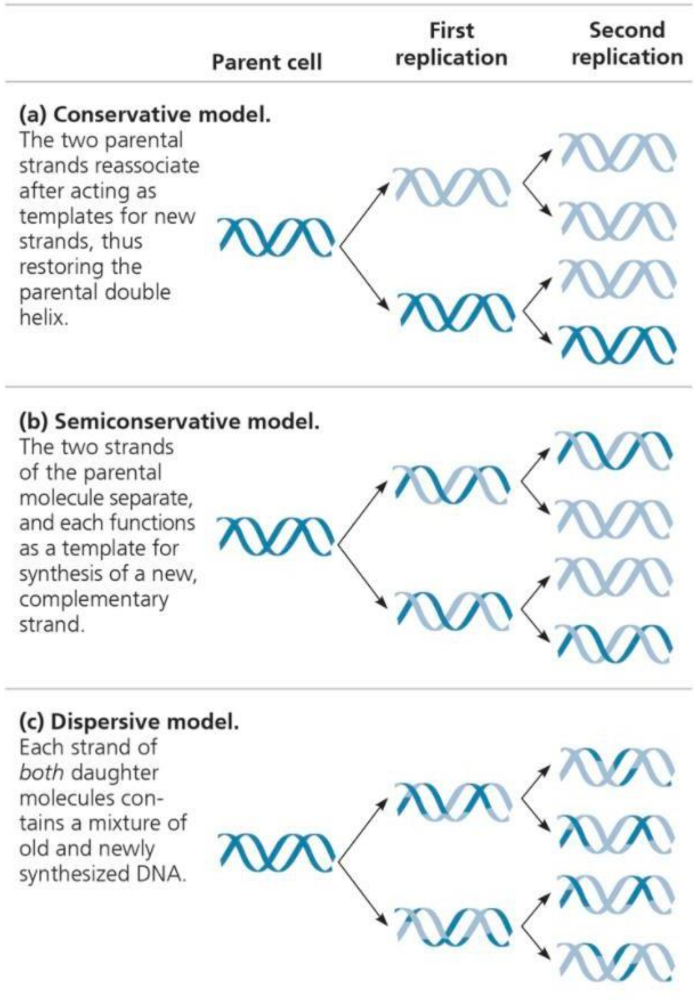
One of the foundational properties of DNA is its *ability to replicate*. This comes from the **complementarity of its strands.**

Each strand has the information needed to construct another strand!

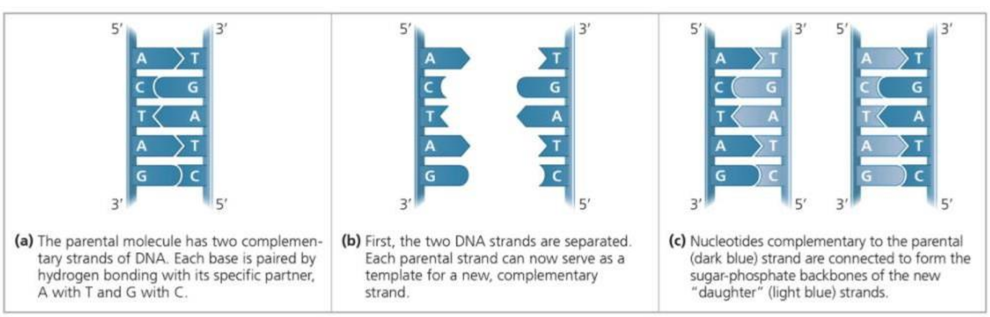
There have been several theories to just exactly how DNA replicates. The **three basic models** are:

1. **Conservative model**: the two parent strands act as templates for new strands but then reconnect and restore the original helix.
2. **Semiconservative model**: the two parents strands of the original molecule separate and serve as templates for new strands. The parent strands remain part of the new molecule.
3. **Dispersive model:** the new strands contain mixtures of old and new strands.

Here is a photo explaining each of these models:




So which model is correct? The semiconservative model!
This model says that *each strand in the parent DNA molecule will act as a template for the synthesis of a new strand and will remain in the new DNA molecule.* After replication, the double helix consists of one old strand and one new strand.




**(a)** The parental molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.
**(b)** First, the two DNA strands are separated. Each parental strand can now serve as a template for a new, complementary strand.
**(c)** Nucleotides complementary to the parental (dark blue) strand are connected to form the sugar-phosphate backbones of the new "daughter" (light blue) strands.

## CHECK YOUR LEARNING:

1. A DNA molecule is found to be composed of 30% cytosine bases. What percentage of the strand is made up of adenosine bases?
2. Why is the backbone of the DNA double helix called the sugar phosphate backbone?
3. Which pairing of nucleotides do you think would be most difficult to break apart: A—T or C—G? Why?

## THINGS YOU MAY STRUGGLE WITH:

1. Students often struggle with answering the first question I listed in the "check your learning" section above. It is important to note that if there is 30% cytosine, this means there will be 30% guanine. This will make up 60% of the strand, leaving 40% to be made up of A and T. The answer for either A or T is NOT 40%! It is actually 20% because you have to divide the percentage between the two bases.
2. Remember that in semiconservative replication, each parent DNA strand will be part of the newly synthesized DNA molecule.

**Thanks for checking out these weekly resources!**
**Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring! Answers to *Check your Learning* questions are below!**

Answers:

1. 20% adenosine
2. The structure of the nucleotides are arranged so that the sugar and the phosphate portion of the nucleotide are positioned on the outside of the strand.
3. C – G would be hardest to break apart because they are connected through 3 hydrogen bonds as opposed to A –T which are connected through just 2 hydrogen bonds.