

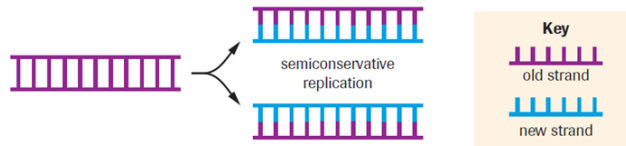
## Topic 3 - DNA Replication

<http://highered.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::535::535::sites/dl/free/0072437316/120076/micro04.swf::DNA%20Replication%20Fork>  
[http://highered.mcgraw-hill.com/sites/0072943696/student\\_view0/chapter3/animation\\_dna\\_replication\\_quiz\\_1\\_.html](http://highered.mcgraw-hill.com/sites/0072943696/student_view0/chapter3/animation_dna_replication_quiz_1_.html)

- When a cell divides, genetic information must be duplicated.
  - o Occurs in which phase of the cell cycle?
- The DNA molecule unwinds and the 2 strands of the DNA separate (unzip) and expose the nitrogen bases.
- Free floating nucleotides join the exposed strands of DNA with the aid of an enzyme (**DNA polymerase**)
- Both strands act as templates.
- The end result is 2 identical DNA strands.
- DNA replication is termed "**Semi-conservative**" replication
  - o because parent strands of DNA act as templates
  - o The new DNA molecule is half old and half new

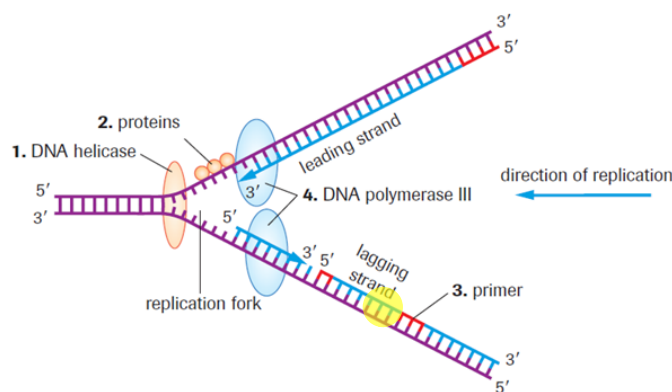
**Figure 3**

DNA replicates semiconservatively. Each daughter molecule receives one strand from the parent molecule plus one newly synthesized strand.



### Part 1: Separating the Strands

- The enzyme **DNA helicase** unwinds the DNA by breaking the hydrogen bonds
  - o Proteins bind to the DNA to prevent them from going back together
- The two strands now act as templates for the 2 new strands to be built



### Part 2: Building the Complementary Strands

- An RNA primer is attached to the template strand
- **DNA polymerase III** adds complementary nucleotides to the template strand in the 5' to 3' direction
- The strand that is created continuously is called the **leading strand**
  - o Moves towards the replication fork
- The **lagging strand** is built in short fragments
  - o Multiple RNA primers are required
- **DNA polymerase I** replaces the RNA primers with DNA nucleotides
- **DNA ligase** *joins* the links the sugar-phosphate backbone together

*Okasaki: Fragments*

Watch the following hyperlink and answer the following questions

<http://highered.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::535::535::/sites/dl/free/0072437316/120076/micro04.swf::DNA%20Replication%20Fork>

- What enzyme breaks the hydrogen bonds between complementary base pairs?
- What prevents the base pairs from forming bonds again?
- What is the area where replication is occurring called?
- What enzyme begins to build the new strand of DNA?
- What direction does DNA polymerase build the new strand in?
- What is required in order for DNA polymerase to begin to build a new strand?
- Why is this required?
- What happens to the RNA primer that started the leading strand?
- What is a lagging strand?
- Why is the lagging strand built discontinuously?
- What are the discontinuous fragments called?
- What enzyme joins the discontinuous fragments together?

**Topic 3 - DNA Replication  
Review Sheet**

1. Differentiate between a purine and a pyrimidine.
2. Fill in the missing information into the table below and supply an appropriate title.

Enzyme	Function
DNA helicase	
DNA polymerase I	
DNA polymerase III	
DNA ligase	

3. A molecule of DNA was analyzed and found to contain 20 % thymine. Calculate the percentage of adenine, guanine, and cytosine in this molecule.

4. Define a replication fork.

5. Complete the missing information in the table below. Explain how you determined the missing values.

Nucleotide	Sample A	Sample B	Sample C
adenine	10 %	35	20 %
guanine	40 %	15 %	30
thymine	10	35 %	20 %
cytosine	40	15	30

6. Correctly fill in the blanks to complete the sentences about DNA replication that are given below.

- \_\_\_\_\_ unzips the double helix by breaking the \_\_\_\_\_ bonds between the complementary bases in the two strands of the parent DNA molecule.
- \_\_\_\_\_ attach to the newly exposed DNA strands, preventing the hydrogen bonds from re-forming and keeping the strands apart.
- \_\_\_\_\_ adds complementary nucleotides to the growing strands, using the exposed strands of the parent DNA molecule as a \_\_\_\_\_.
- The \_\_\_\_\_ strand is formed continuously.
- The \_\_\_\_\_ strand is formed in short fragments, starting from an \_\_\_\_\_ primer.
- \_\_\_\_\_ cuts out the RNA primers and replaces them with the appropriate DNA nucleotides.
- \_\_\_\_\_ joins the fragments together to form a complete DNA strand.

Use the following information to answer the next two questions.

In DNA replication, the two strands of the double helix separate and a new strand forms along each old one. Each new DNA molecule has one old and one new strand.

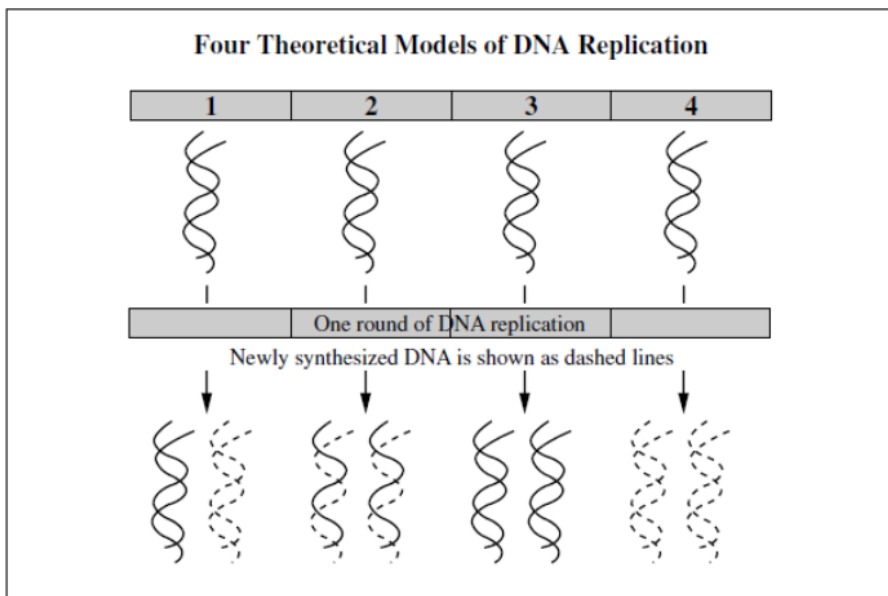
The name of the old DNA strand and the site of DNA replication are identified in row

Row	Name of Old Strand	Site
<b>A.</b>	a template	nucleus
<b>B.</b>	a template	cytoplasm
<b>C.</b>	haploid	nucleus
<b>D.</b>	haploid	cytoplasm

The backbone of a DNA molecule and the composition of A, C, T, and G are identified in row

Row	DNA Backbone	A, C, T, and G
<b>A.</b>	phosphate groups	deoxyribose sugars
<b>B.</b>	purines	deoxyribose sugars
<b>C.</b>	pyrimidines	nitrogen-containing bases
<b>D.</b>	sugars and phosphate groups	nitrogen-containing bases

Use the following information to answer the next question.



Which number represents the model of DNA replication that occurs in human cells?

- A. 1
- B. 2**
- C. 3
- D. 4

