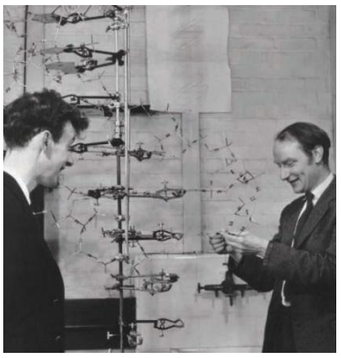


Watson and Crick did not conduct any experiments to determine the structure of DNA. Instead, they worked as synthesizers, examining and interpreting the research and discoveries made by other scientists. As well, Watson and Crick used a technique that was used previously by the chemist Linus Pauling to visualize and determine the helical structure of proteins by building physical models. Watson and Crick tried different arrangements until they created one model that could account for all the evidence. In this investigation, you will work in a group to design and build a model that can be used to simulate the structure and replication of DNA.

Question

How can you design a working model of a short strand of DNA (10 base pairs) that can be used to simulate the molecular structure of DNA and the process of DNA replication?

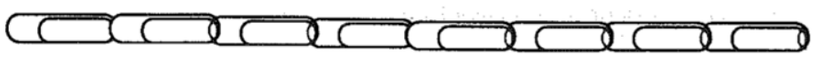
You will be making a short sequence of a human gene that controls the body's production of the growth hormone (hGH), which causes growth during childhood and adolescence. This gene is actually made of 573 nucleotide base pairs. You will only construct the first ten bases in the gene. Use the materials provided by your teacher to create a working DNA model.

Materials

14 _____ Paper Clips (Adenine) 9 _____ Paper Clips (Cytosine)
9 _____ Paper Clips (Guanine) 14 _____ Paper Clips (Thymine)

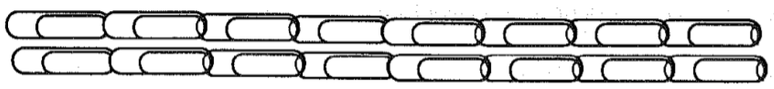
1.) Use the colored paper clips according to the key above and construct the primary (top) strand of the hGH according to the diagram of the gene below. Link the ten appropriate colored clips.

1	2	3	4	5	6	7	8	9	10
A	A	G	C	T	T	A	T	G	G



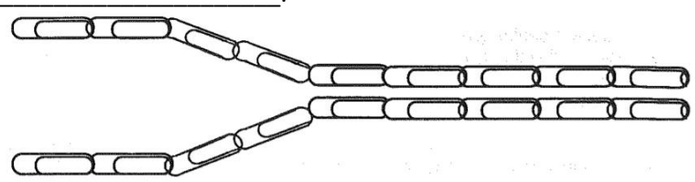
2.) Now construct the complementary (bottom) strand of the hGH gene by linking ten more clips into a chain below the strand you just created.

Write the complementary base chain here: _____

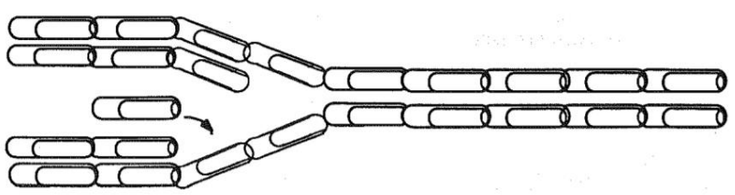


3.) Set the two chains side-by-side as shown in the drawing above so that A bonds with T, and C bonds with G.

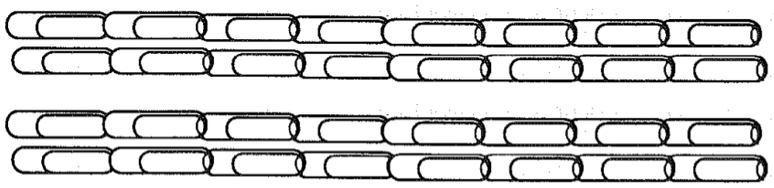
4.) **Initiation:** Open your hGH DNA molecule as shown below: The enzyme responsible for unzipping the DNA molecule is _____.



5.) **Elongation:** Now use the other available clips to create the beginning of two new strands. Remember A with T and C with G. Connect the clips as follows: The enzyme that adds new nucleotides is _____.



Continue separating the strands and bring in appropriate new bases (clips) to create two complete new double-stranded hGH gene molecules. Remember that A bonds opposite to T, and C is opposite of G.



Proofreading: After each nucleotide is added to a new DNA strand, DNA polymerase can recognize whether or not hydrogen bonding is taking place between the new base and its complement on the original strand. The absence of hydrogen bonding indicates a mismatch between the bases. When this occurs, DNA polymerase excises the incorrect base from the new strand and adds the correct base using the parent strand as a template.

Termination: As soon as the newly formed strands are complete, they rewind automatically into their chemically stable helix structure. Replication proceeds until the new strands are complete and the two new DNA molecules separate from one another.

Question

Are the two new strands of DNA you created identical? _____ Why?

_____

_____

_____

_____

6.) **Mutations:** To demonstrate a gene mutation, place one of your paper clip hGH DNA strands in front of you. Identify the second nucleotide base called Adenine (A). To cause a mutation, remove this Adenine (A) clip and replace it with a Cytosine (C) clip. You have just demonstrated how a mutation occurs. This replacement usually occurs when the DNA is replicating. We will learn about mutations later.

1	2	3	4	5	6	7	8	9	10
A		G	C	T	T	A	T	G	G

What is the new sequence of your complementary strand?

1	2	3	4	5	6	7	8	9	10