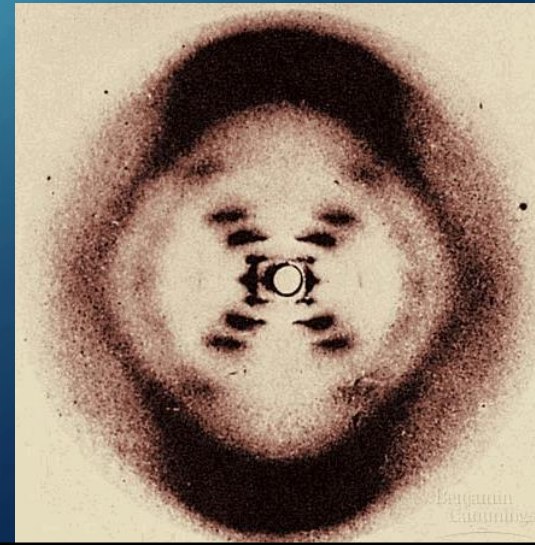


DNA STRUCTURE & REPLICATION



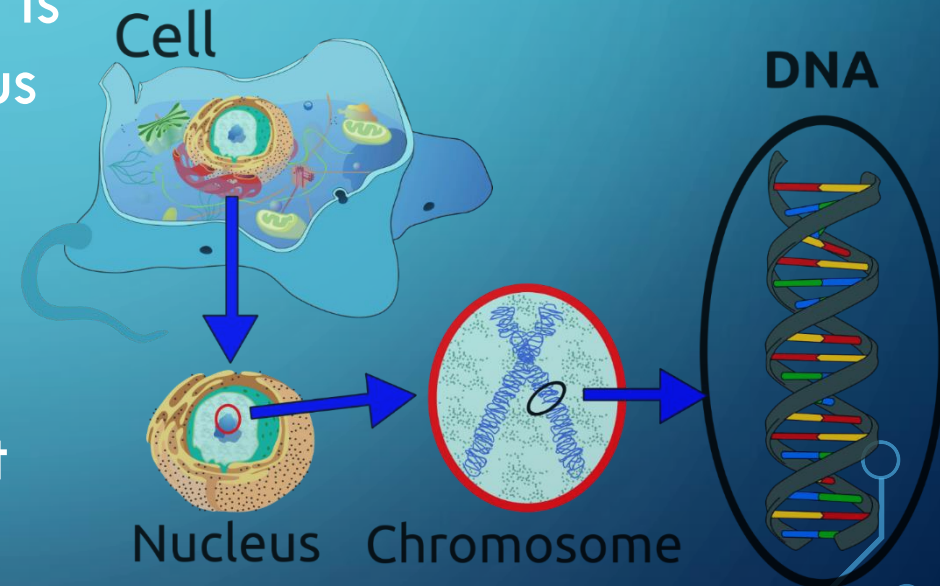
A MODEL OF DNA

- In 1953, two scientists named Watson & Crick built a model of DNA that demonstrates its exact structure and function.
- They called this model a **double helix**, which is also often referred to as a twisted ladder.
- A woman named Rosalind Franklin is actually responsible for performing an x-ray on a chromosome. This initiated Watson & Crick's double-helix design.



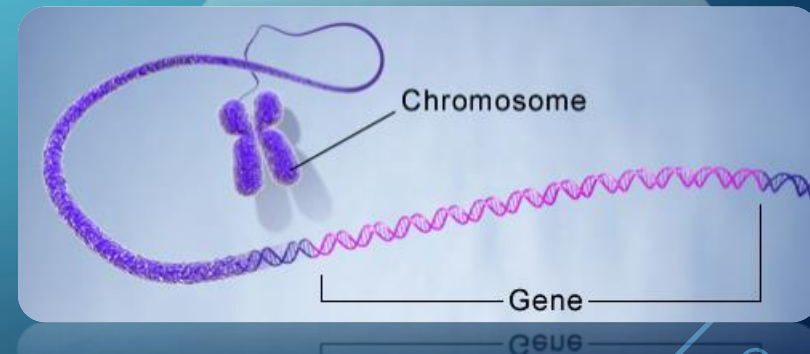
DNA: THE THREAD OF LIFE

- DNA (also known as deoxyribonucleic acid) is a long molecule that makes up our **chromosomes** & is located inside the nucleus of a cell.
- DNA is known as the thread of life because it contains all of the information to direct our body's functions in order to sustain life.



CHROMOSOMES

- **Chromosomes** are made of DNA
- Segments of DNA in specific patterns are called **genes**
- Chromosomes are not always visible. They are uncoiled and as loose strands called **chromatin**
 - When it's time for the cell to reproduce, they condense and wrap up very tightly to form a chromosome



THE ROLE OF DNA

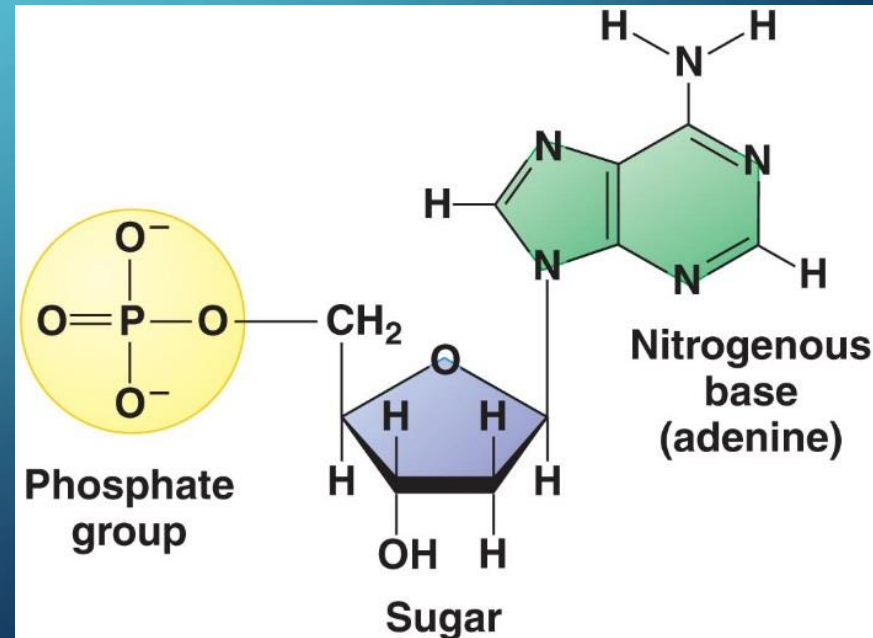
- The DNA that makes up genes must be capable of storing, copying, and transmitting the genetic information in a cell.
- The 3 functions of DNA are:
 - 1. *Storing Information*
 - 2. *Copying information*
 - Before a cell divides, it must make a complex copy of every one of its genes
 - 3. *Transmitting information*
 - DNA must be carefully sorted and passed along during cell division so that it is transmitted from one generation to the next.

THE STRUCTURE OF DNA

- DNA is a long molecule made up of monomers called **nucleotides**

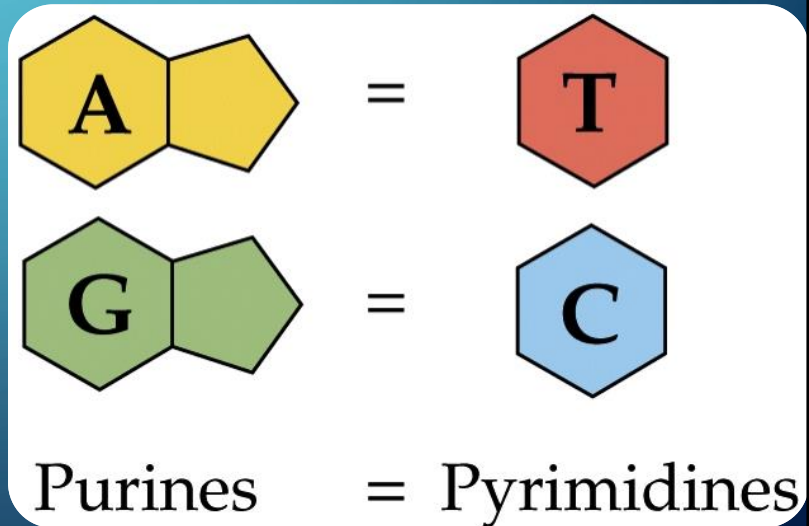
- Nucleotides are made of three parts

1. 5-carbon sugar (deoxyribose)
2. Phosphate group
3. Nitrogenous base



NITROGENOUS BASES

- There are **four** kinds of nitrogenous bases.
- They are divided into two types- purines and pyrimidines.
 - **Purines:** Adenine and Guanine
 - **Pyrimidines:** Cytosine and Thymine

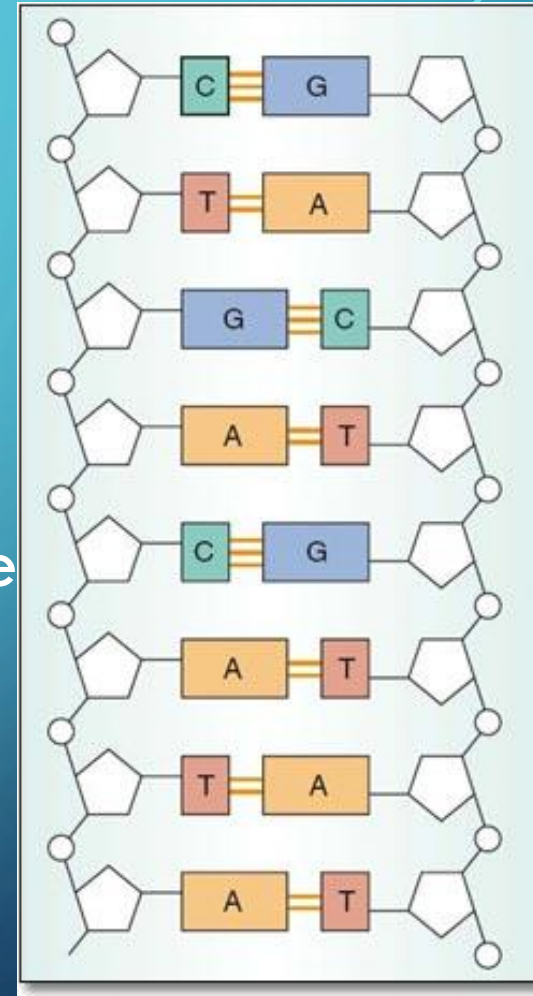


Purines

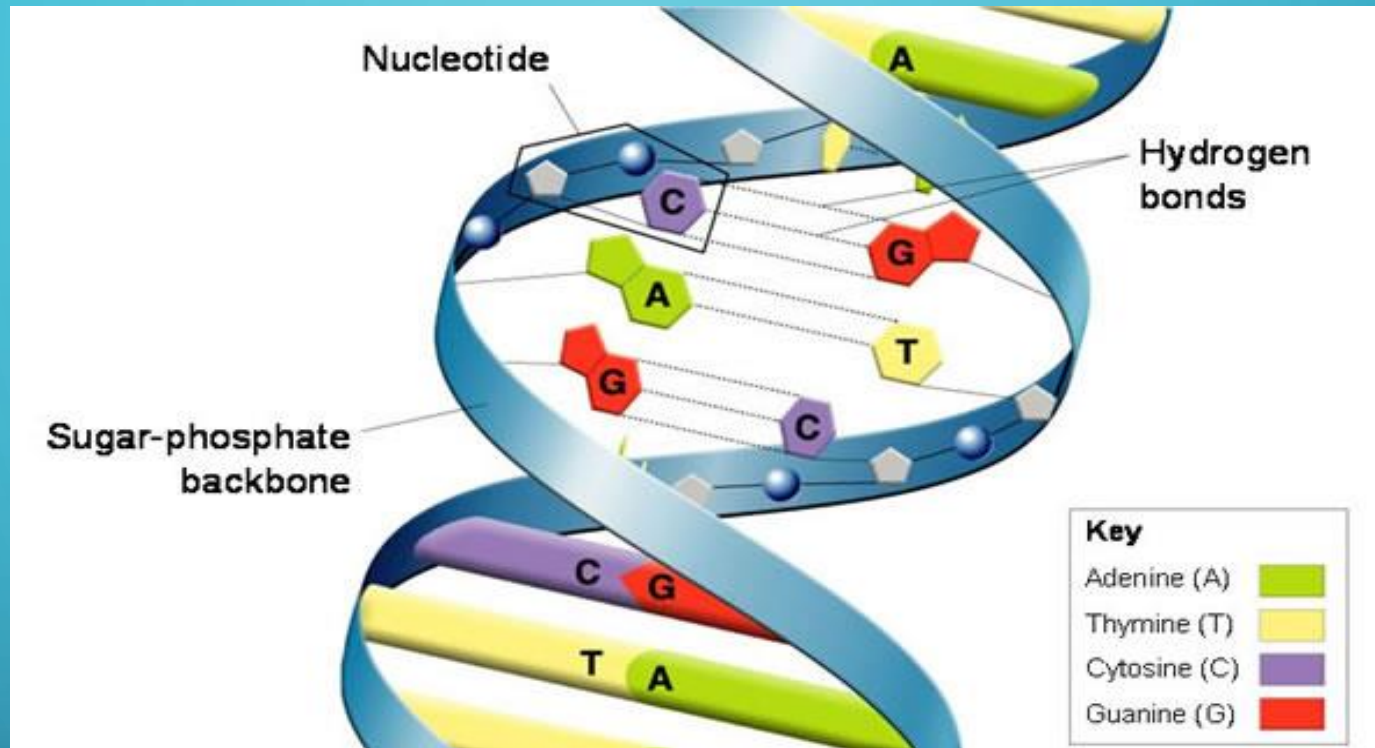
= Pyrimidines

BASE PAIRING

- Because of the size and shape of the nitrogen bases, there are certain ones that always **pair** together.
 - Adenine & Thymine (**A-T**)
 - Cytosine & Guanine (**C-G**)
- **Chargaff's** Rule states that the pyrimidine & purine bases have a 1:1 ratio
 - The amount of guanine is equal to cytosine
 - The amount of adenine is equal to thymine
- These nitrogenous bases form the rungs/**steps** of the DNA molecule



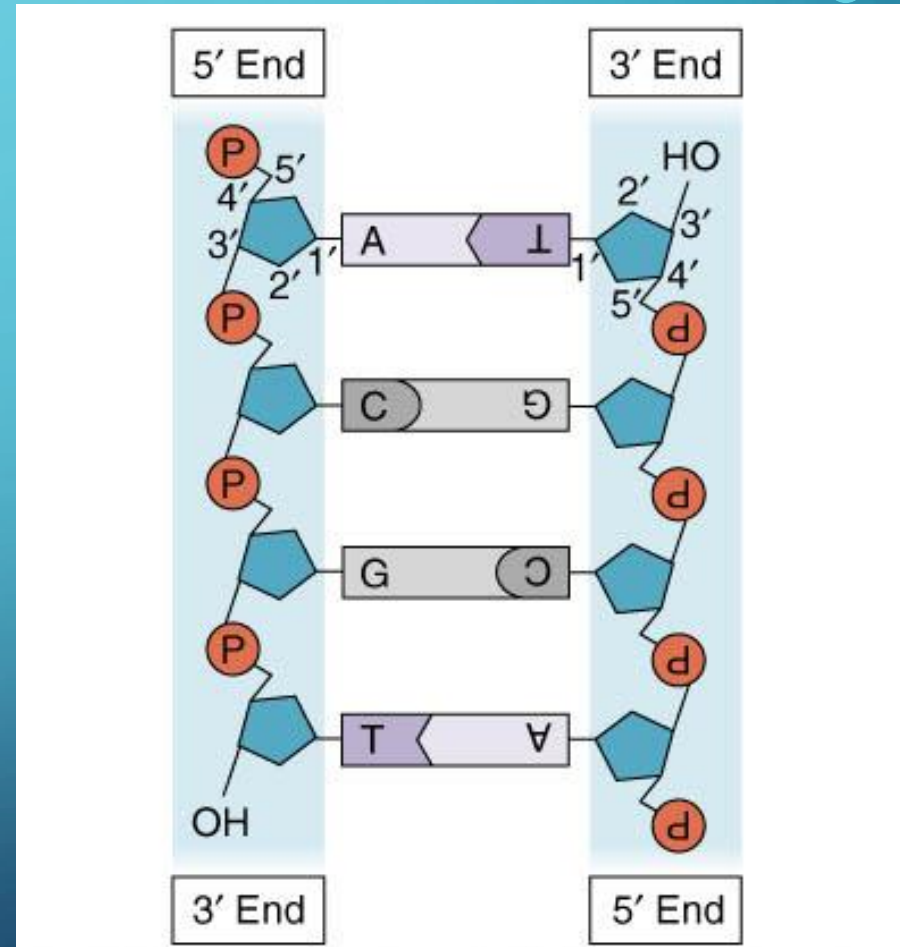
HYDROGEN BONDS



- Weak **hydrogen** bonds form between the nitrogen bases to hold the two strands of DNA together
 - Adenine and Thymine are held together by a **double** hydrogen bond
 - Cytosine and Guanine are held together by a **triple** hydrogen bond

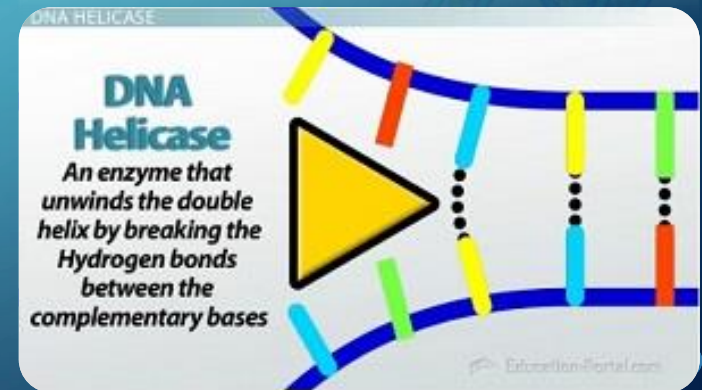
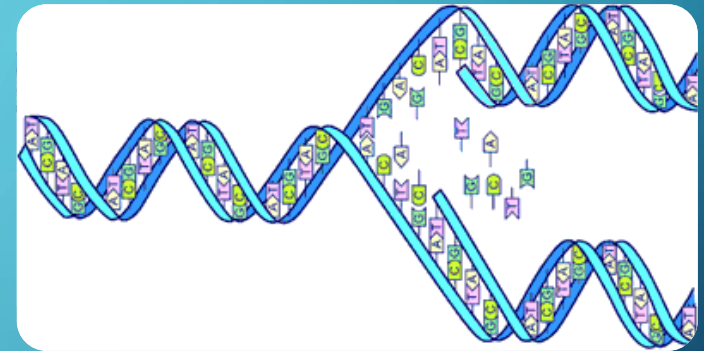
DNA'S ANTIPARALLEL STRUCTURE

- The strands of DNA are **antiparallel**
 - the two strands run in opposite directions
- All DNA strands are read from the **5'** to the **3'** end
 - the 5' end ends with a phosphate group
 - the 3' end ends with a sugar molecule

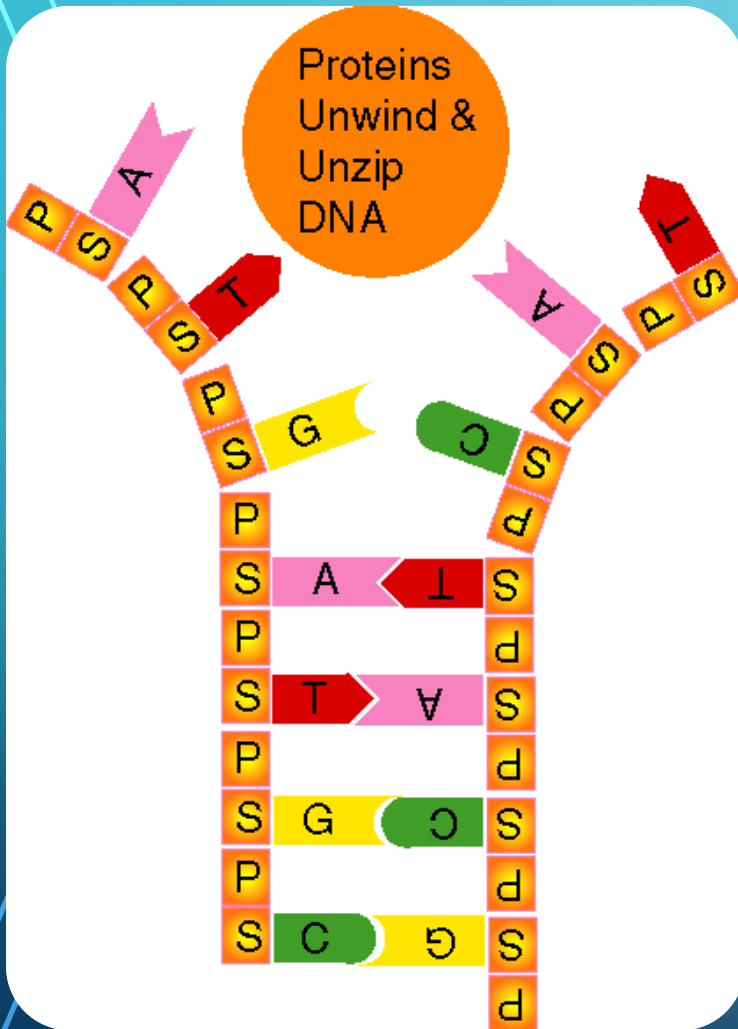


DNA REPLICATION

- **DNA Replication** is the copying process by which a cell duplicates its DNA
 - Occurs during S phase of the cell cycle in the **nucleus**
- In order to do this, the enzyme **DNA helicase** moves along a molecule of DNA and breaks the weak hydrogen bonds between the nitrogen bases.



DNA REPLICATION

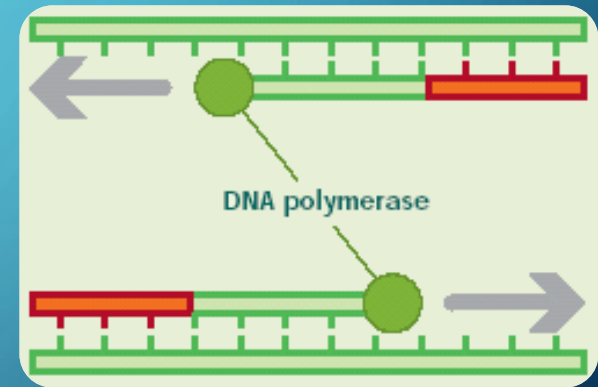


When they do this they “**unzip**” the ladder, which comes apart and the two sides of the ladder separate.

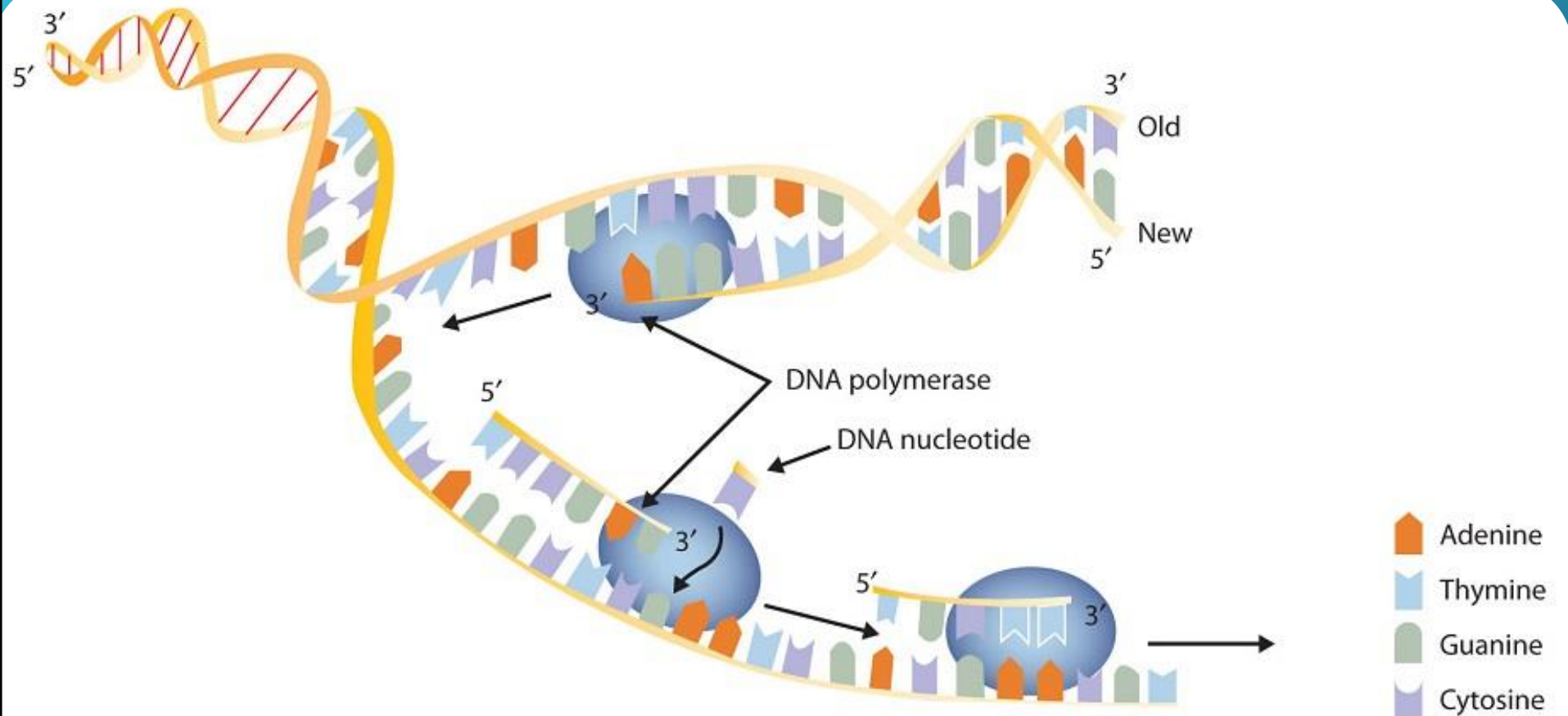


DNA REPLICATION

- **DNA polymerase** comes along afterward and carries the individual nucleotides to the site of replication
 - builds the daughter strand by matching new nucleotides to their complementary bases on the parent strand
- DNA polymerase elongates the DNA strand in the **5'-3'** direction only
 - Because of this, DNA polymerase has to work **backwards** on one strand
- DNA replication proceeds until each chromosome is completely copied.

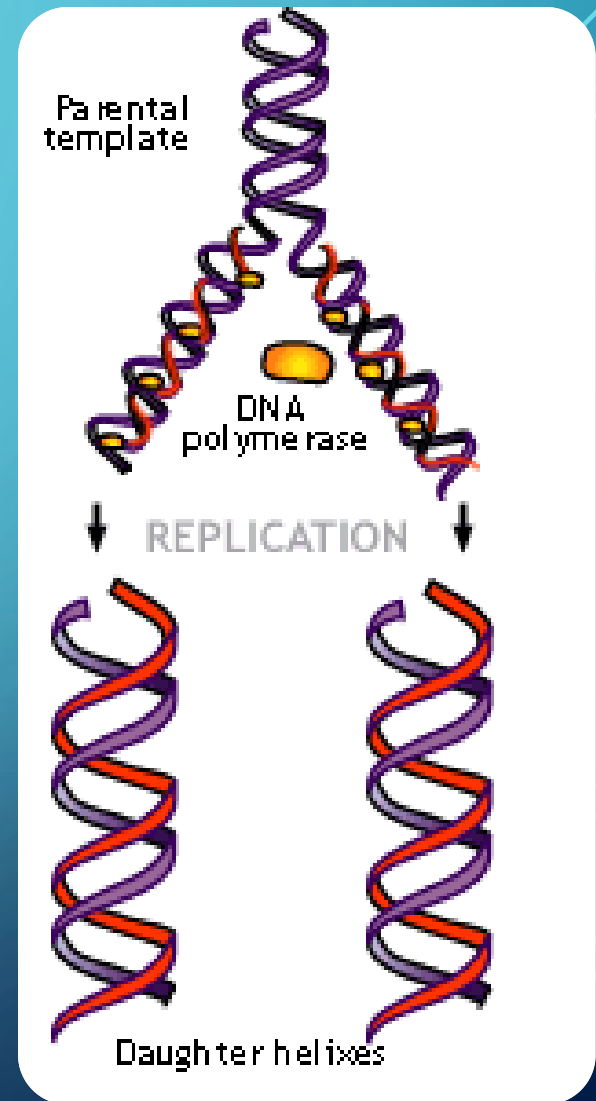


DNA REPLICATION

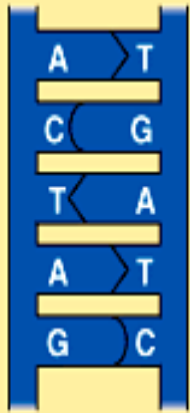


DNA REPLICATION

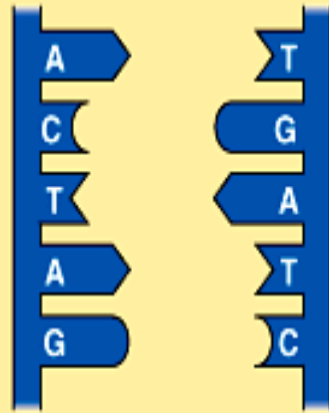
- Each new strand of DNA now has **half** of the old strand that came apart and half of a new strand that was just created.
- At the end of replication, there are 2 new identical strands of DNA
 - 1 side is from the original DNA strand (parent/template)
 - The other side is the newly formed strand that was “copied” (daughter)



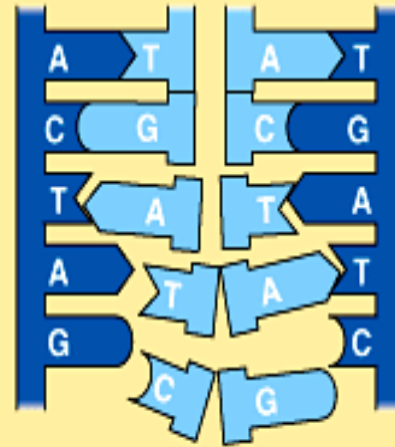
DNA REPLICATION



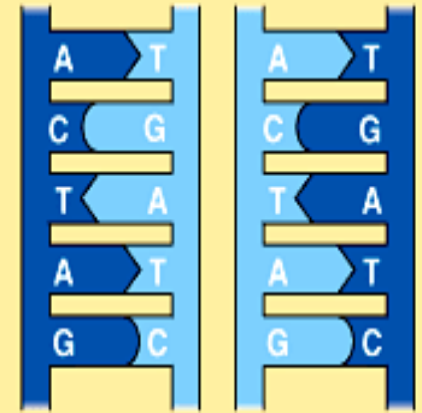
(a) The parent molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.



(b) The first step in replication is separation of the two DNA strands.



(c) Each parental strand now serves as a template that determines the order of nucleotides along a new complementary strand.



(d) The nucleotides are connected to form the sugar-phosphate backbones of the new strands. Each "daughter" DNA molecule consists of one parental strand and one new strand.

DNA REPLICATION

