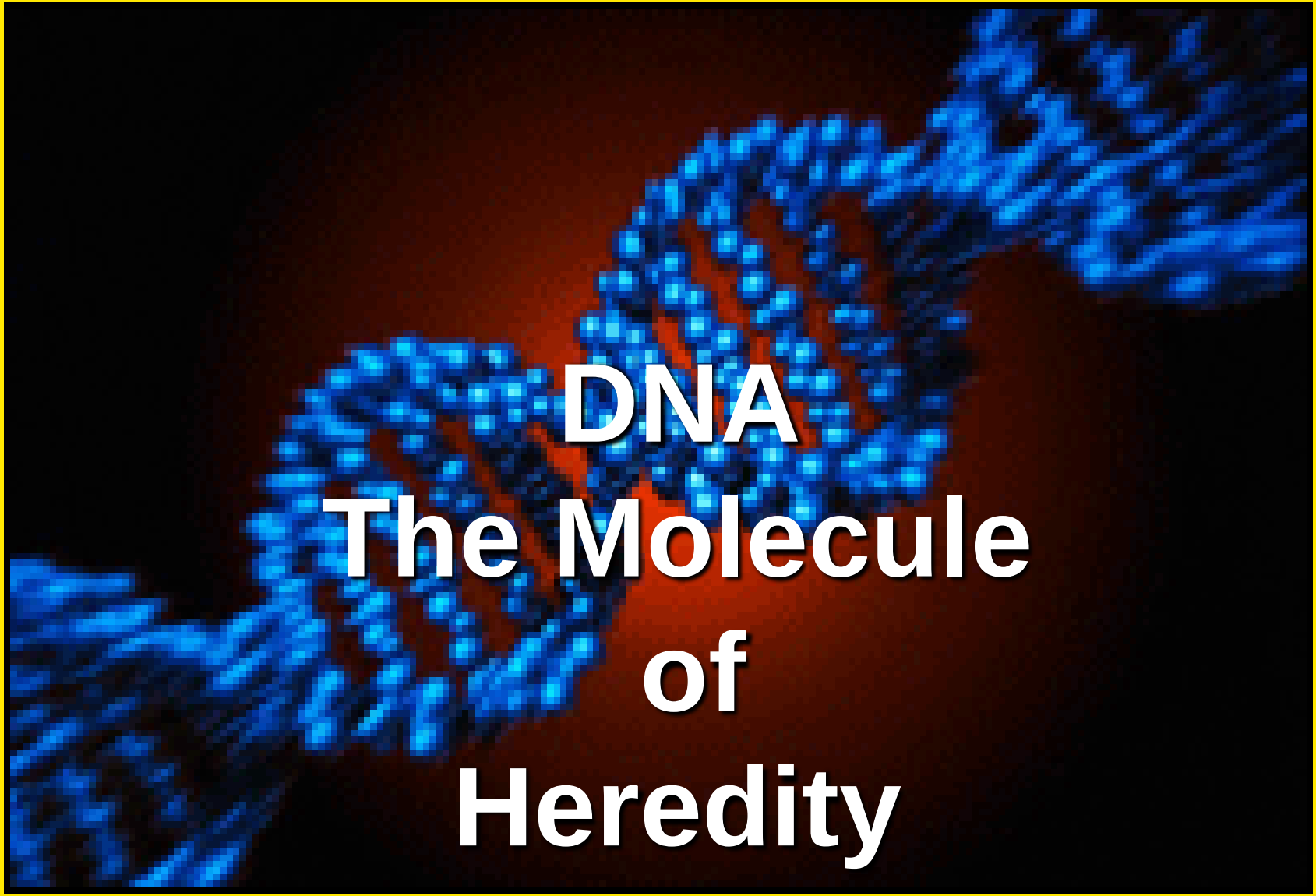
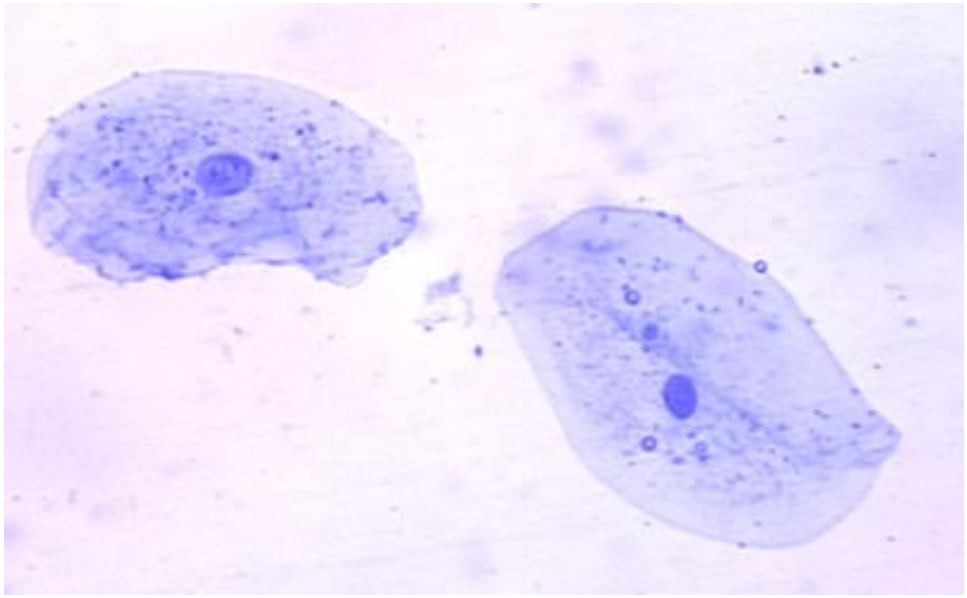
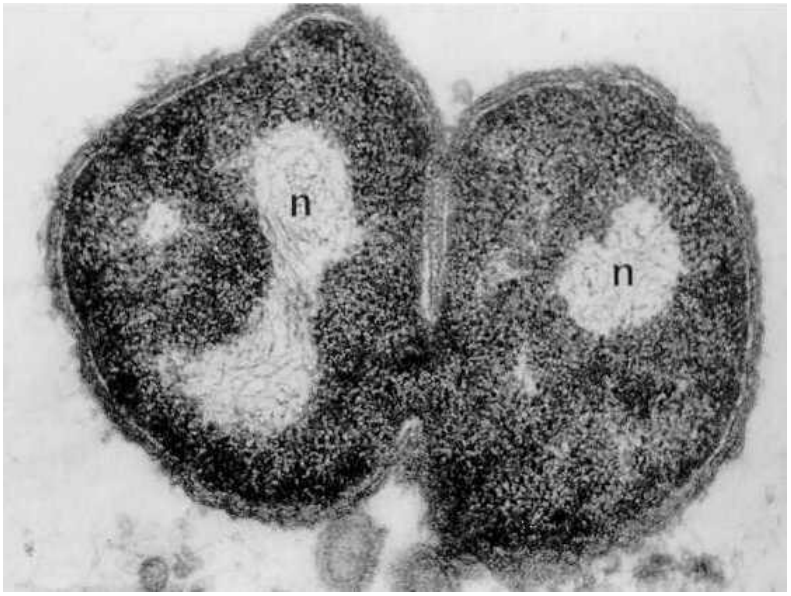

DNA
The Molecule
of
Heredity

DNA

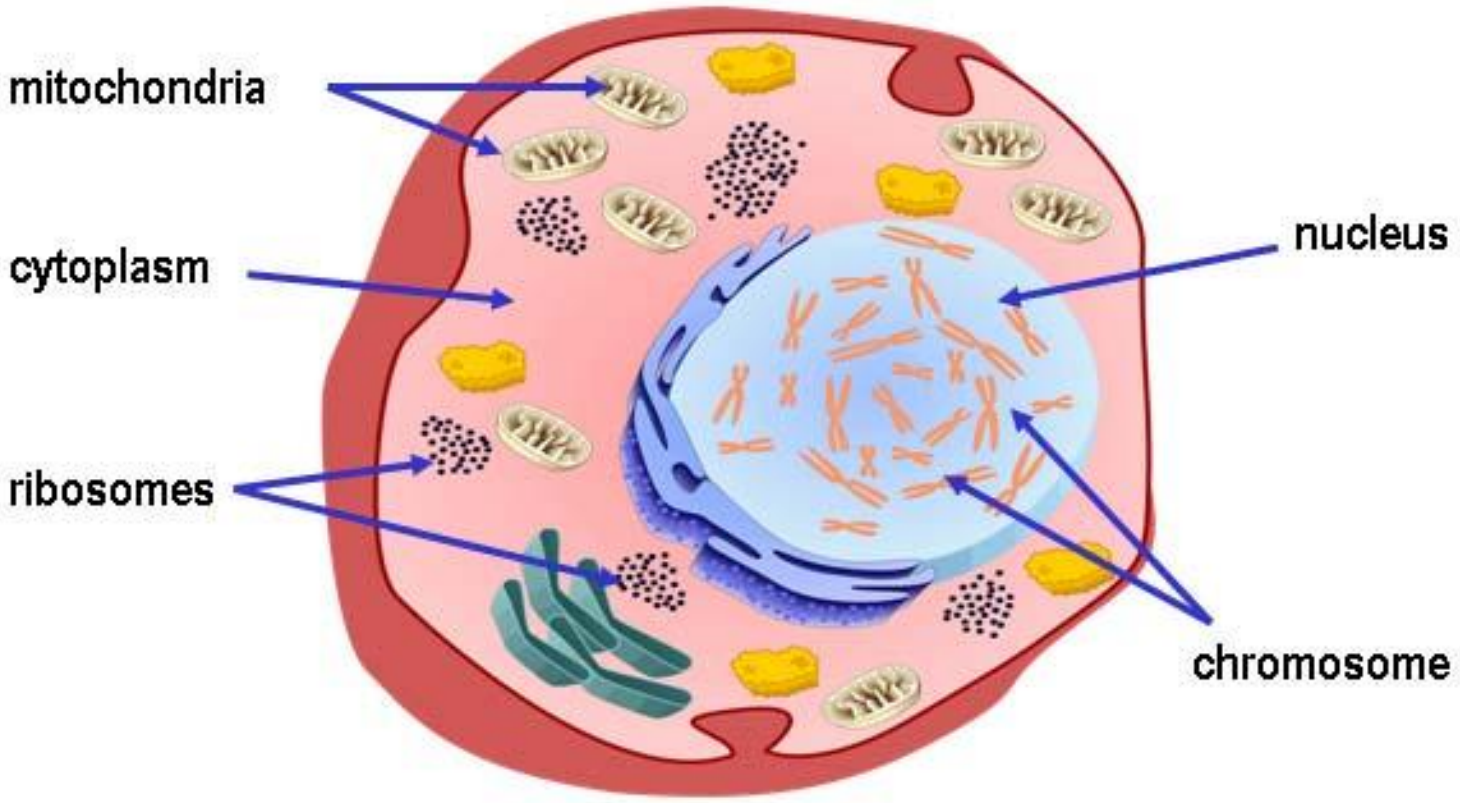
- Deoxyribose Nucleic Acid
  - "instructions for life" for all cells
  - In nucleus of eukaryotes; in cytoplasm of prokaryotes





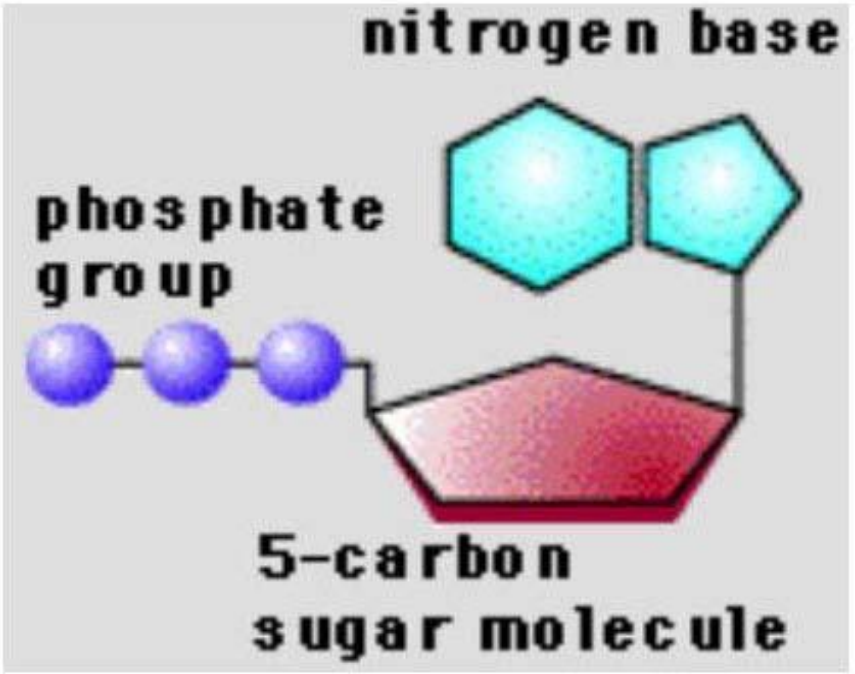
DNA

- Controls the cell
  - By producing protein



Structure of DNA

- DNA is a nucleic acid made of nucleotide subunits

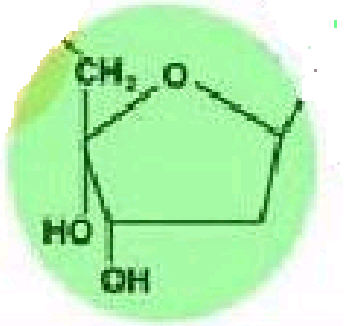


General structure of a nucleotide

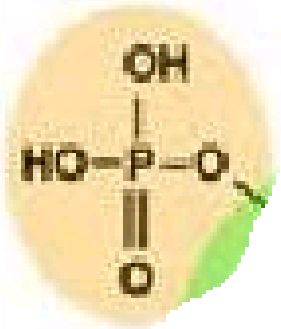
Structure of DNA

Each nucleotide contains 3 parts

1. Deoxyribose-
   a simple sugar



2. Phosphate group



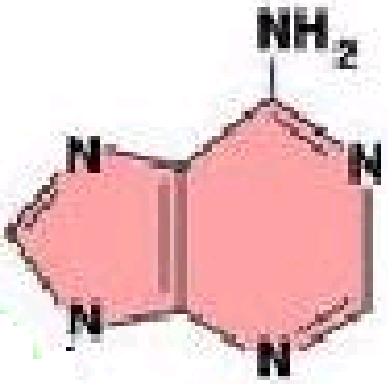
3. Nitrogen Base-4 different types

Structure of DNA

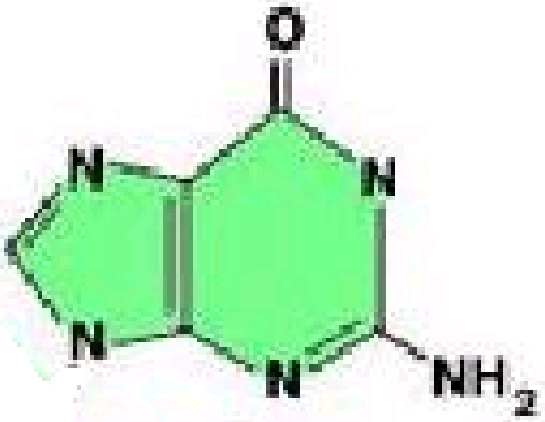
4 Nitrogen Bases-

Double ringed bases

1. Adenine (A)
2. Guanine (G)



adenine



guanine

Structure of DNA

4 Nitrogen Bases-

Single ringed bases

3. Thymine (T)

4. Cytosine (C)

Structure of DNA

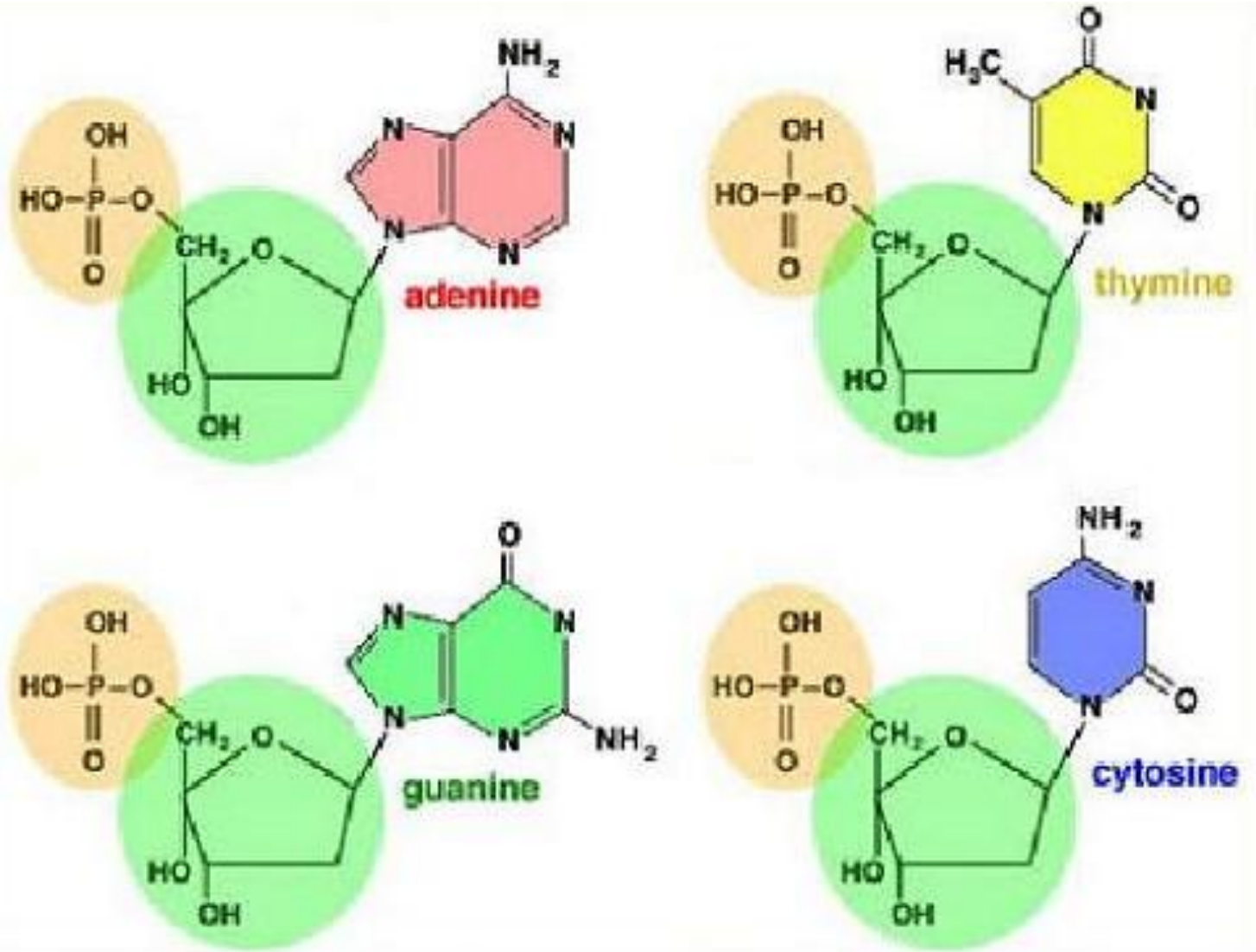
Each nucleotide contains:

1 phosphate

1 deoxyribose sugar

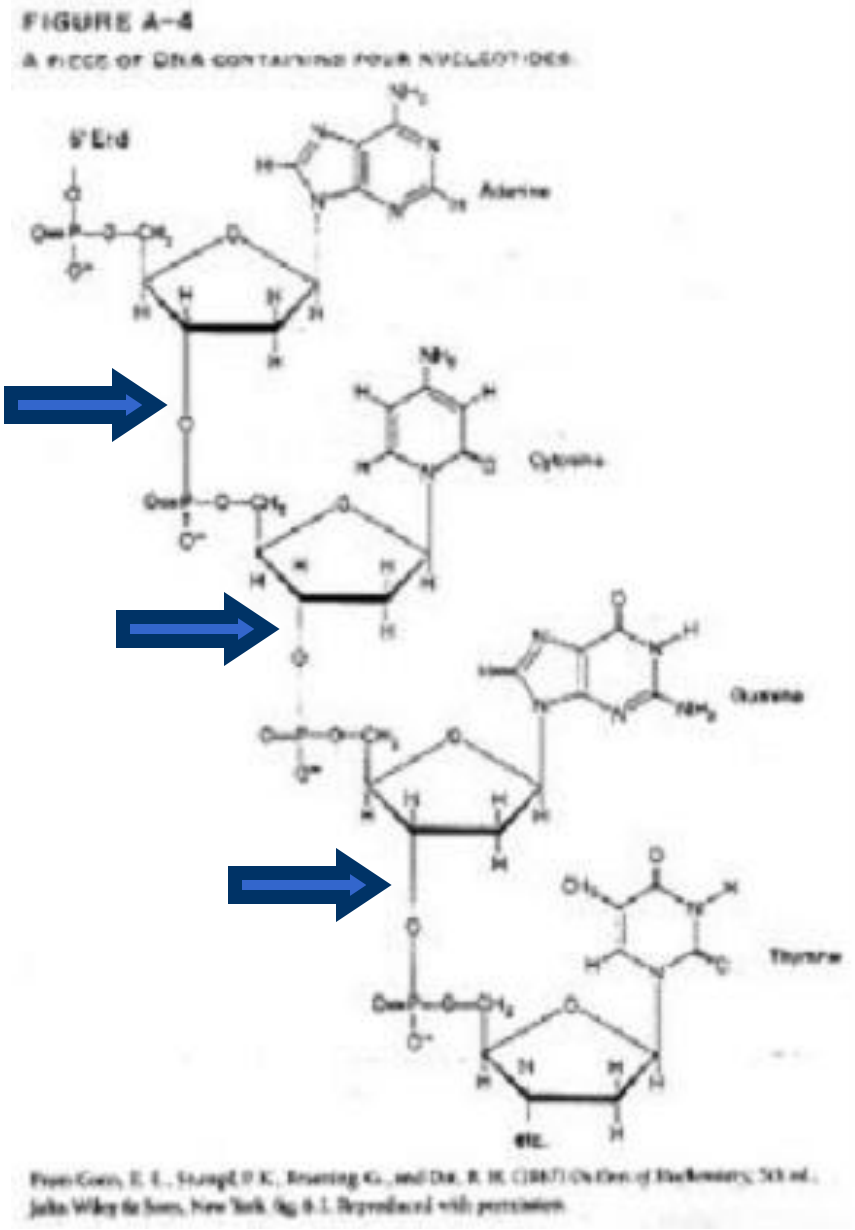
1 of the 4 nitrogen bases

4 Nucleotides of DNA



Structure of DNA

Nucleotides are linked together to form DNA

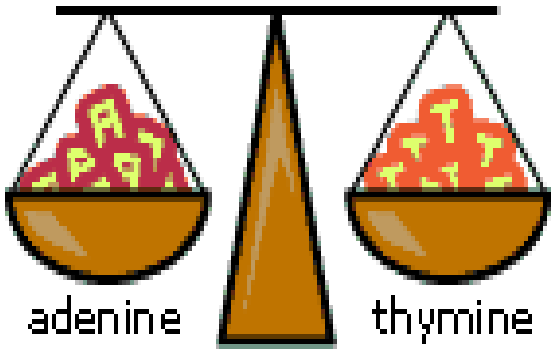


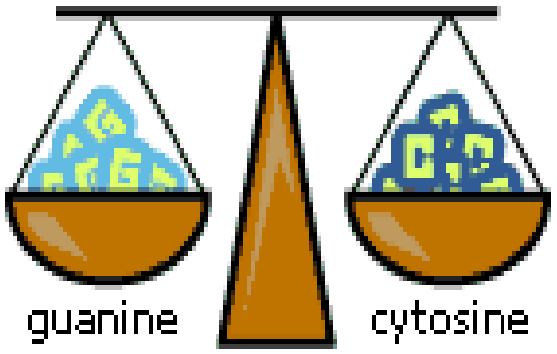
Discovery of DNA Structure

- 1940's- scientists *knew* DNA was:
  - The molecule of life
  - A nucleic acid
  - Made of 4 nucleotides
    - A, T, C, G
  - In any cell the amounts of

    A *always* =T and

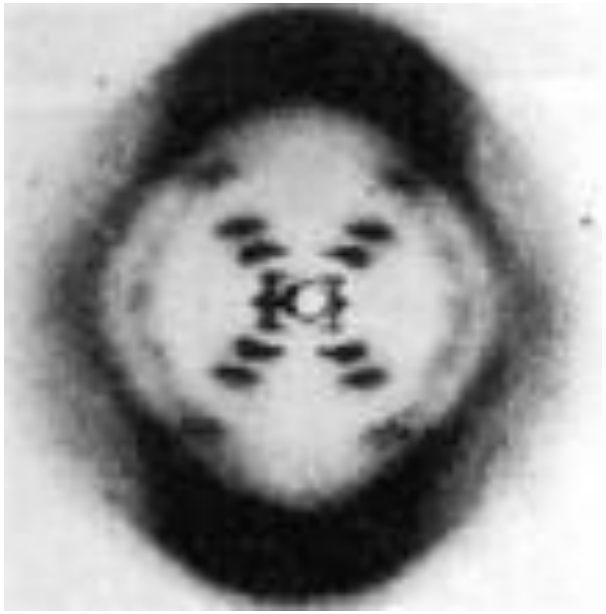
    C *always* = G





Discovery of DNA Structure

- 1950's: Rosalind Franklin studied DNA using a technique called x-ray diffraction.
  - Added information on the shape of the molecule

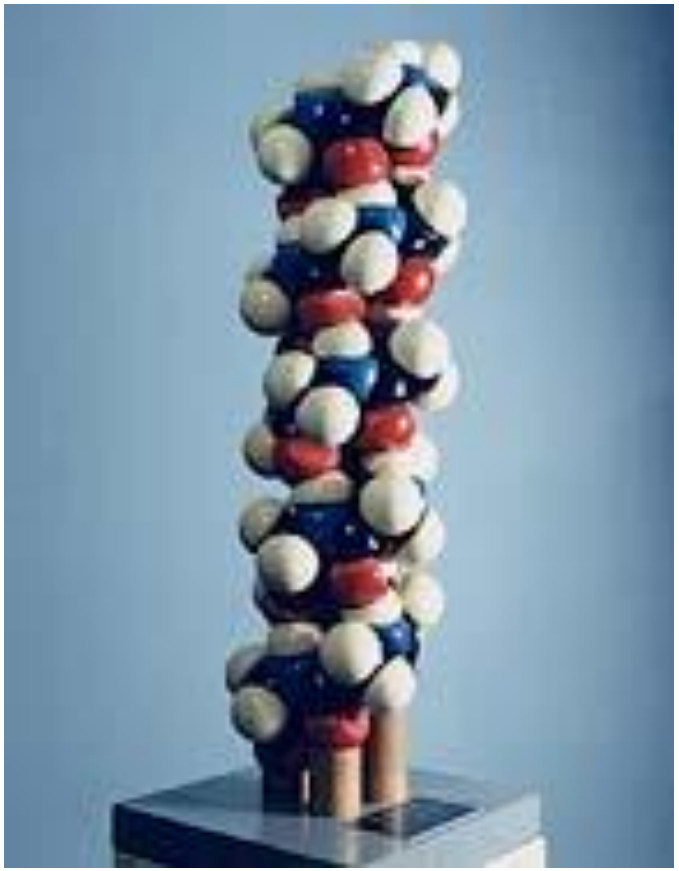


Discovery of DNA Structure

What they *didn't know* was how it all fit together in the molecular structure of DNA !

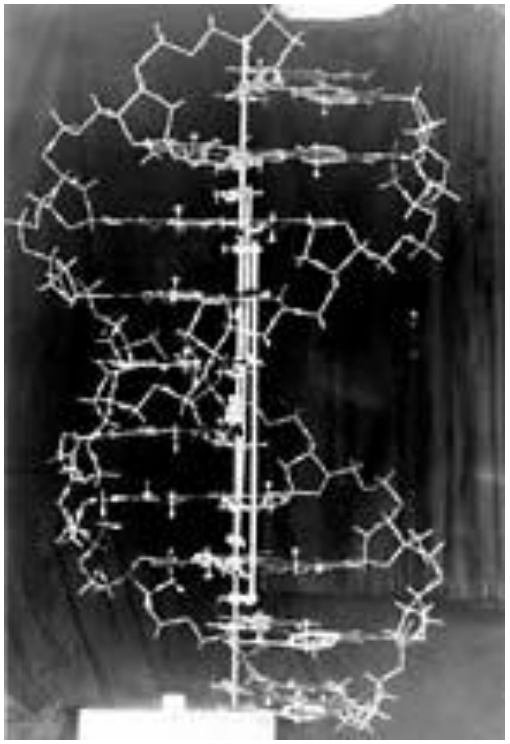
Linus Pauling with a model of the alpha helix

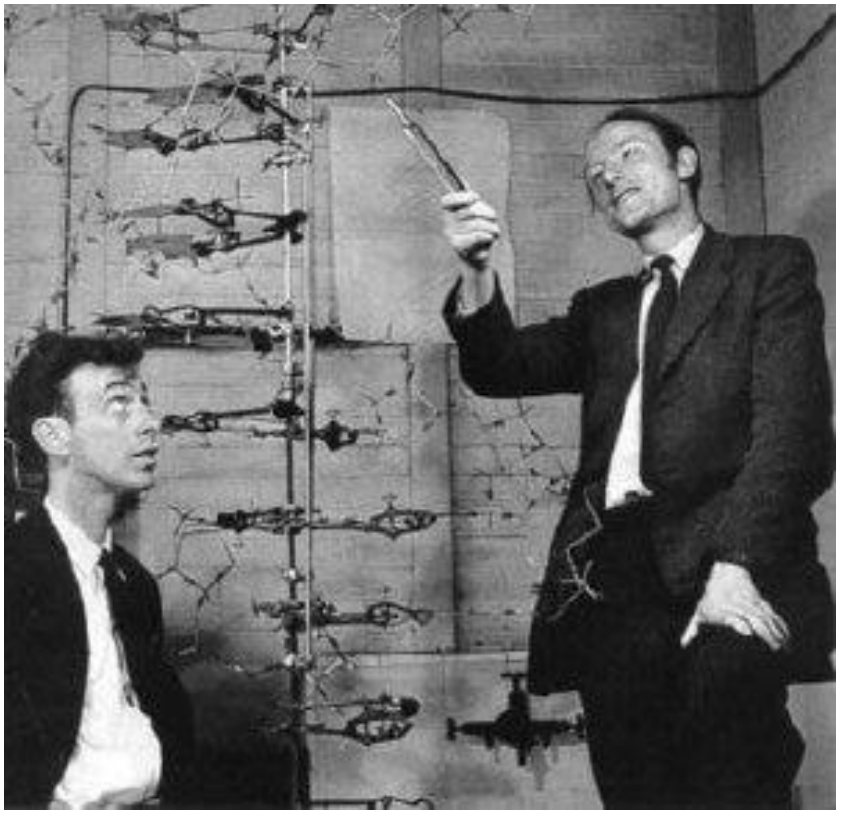
(Photo courtesy of OSU's Special Collections)



Discovery of DNA Structure

- 1953 Watson and Crick discovered DNA is a double helix

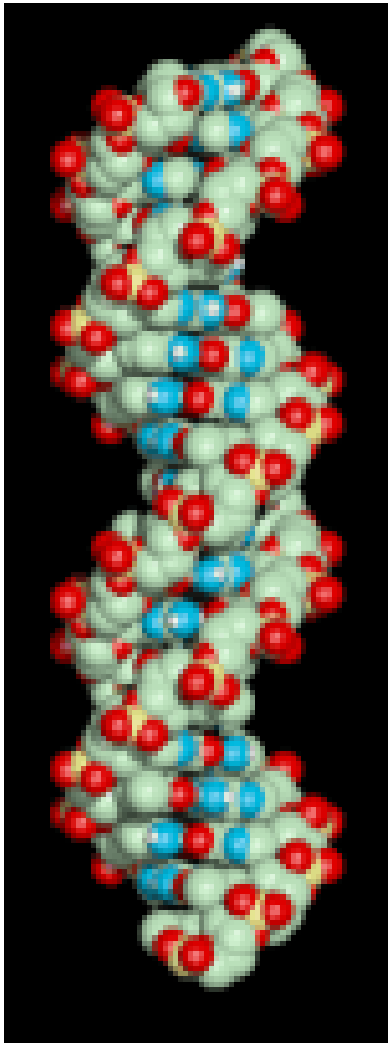




Discovery of DNA Structure

DNA Double Helix:

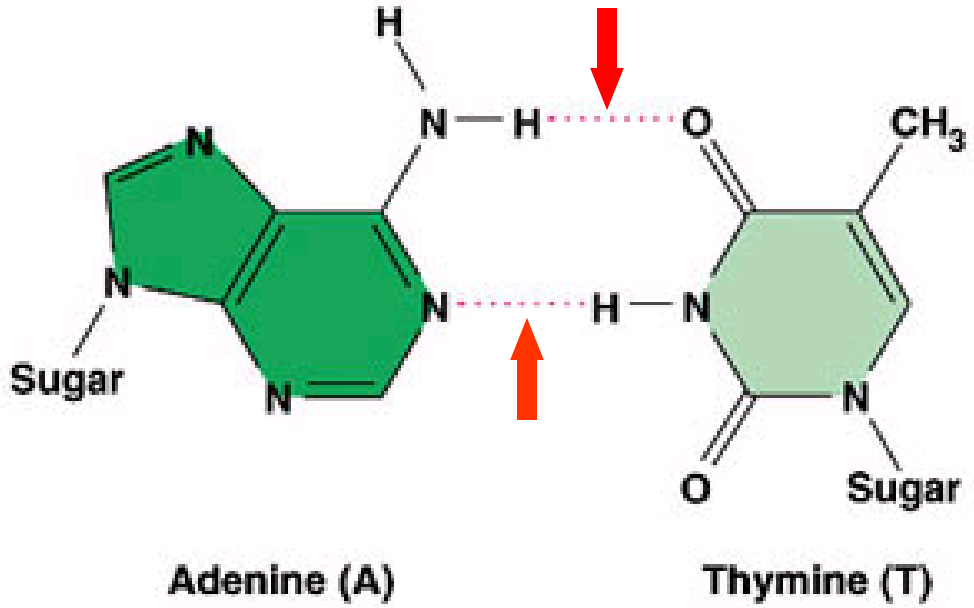
- 2 strands of DNA in a twisted ladder
- Sugar and phosphate alternate the sides of the ladder
- Nitrogen base pairs are the steps of the ladder according to the **base pairing rule**



Discovery of DNA Structure

Base Pairing Rule

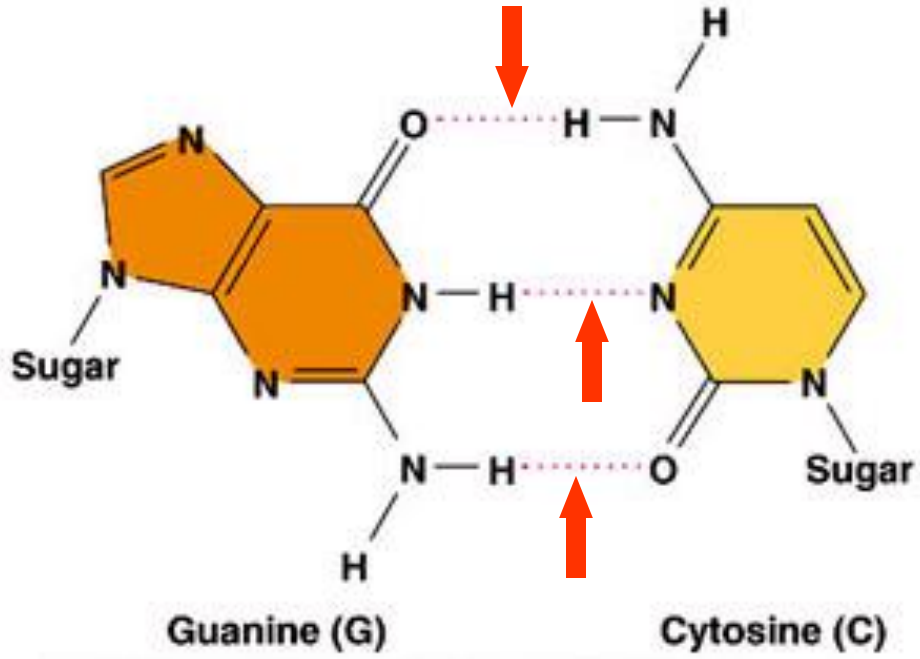
A pairs with T with 2 Hydrogen bonds



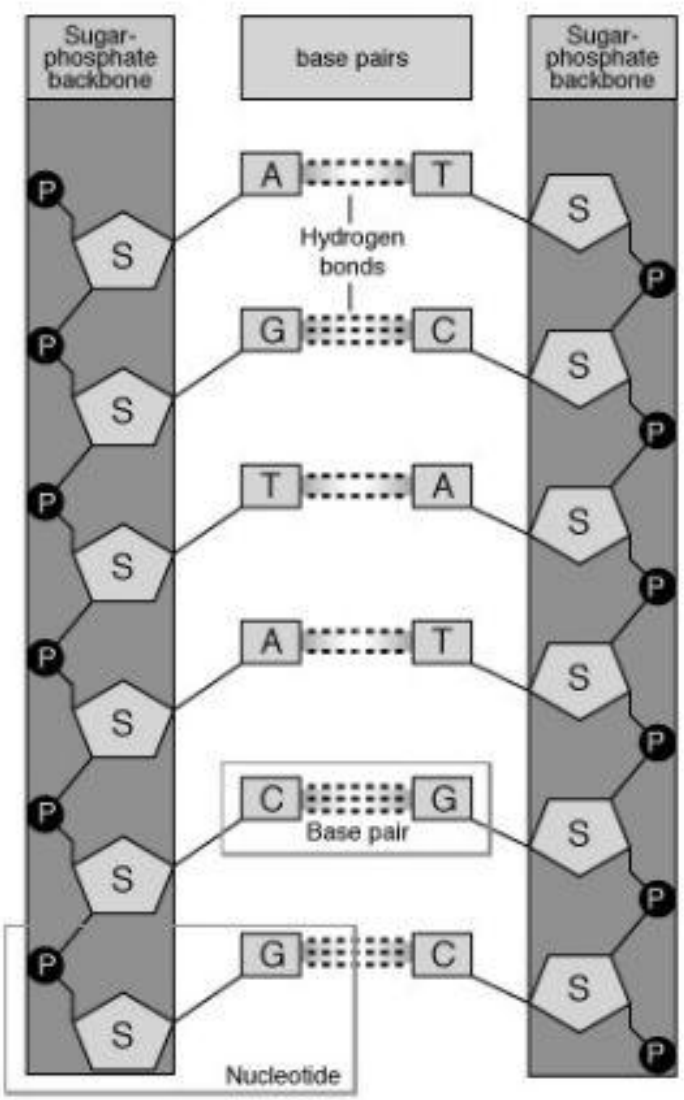
Discovery of DNA Structure

Base Pairing Rule

C pairs with G with 3 Hydrogen bonds



DNA Double-Helix



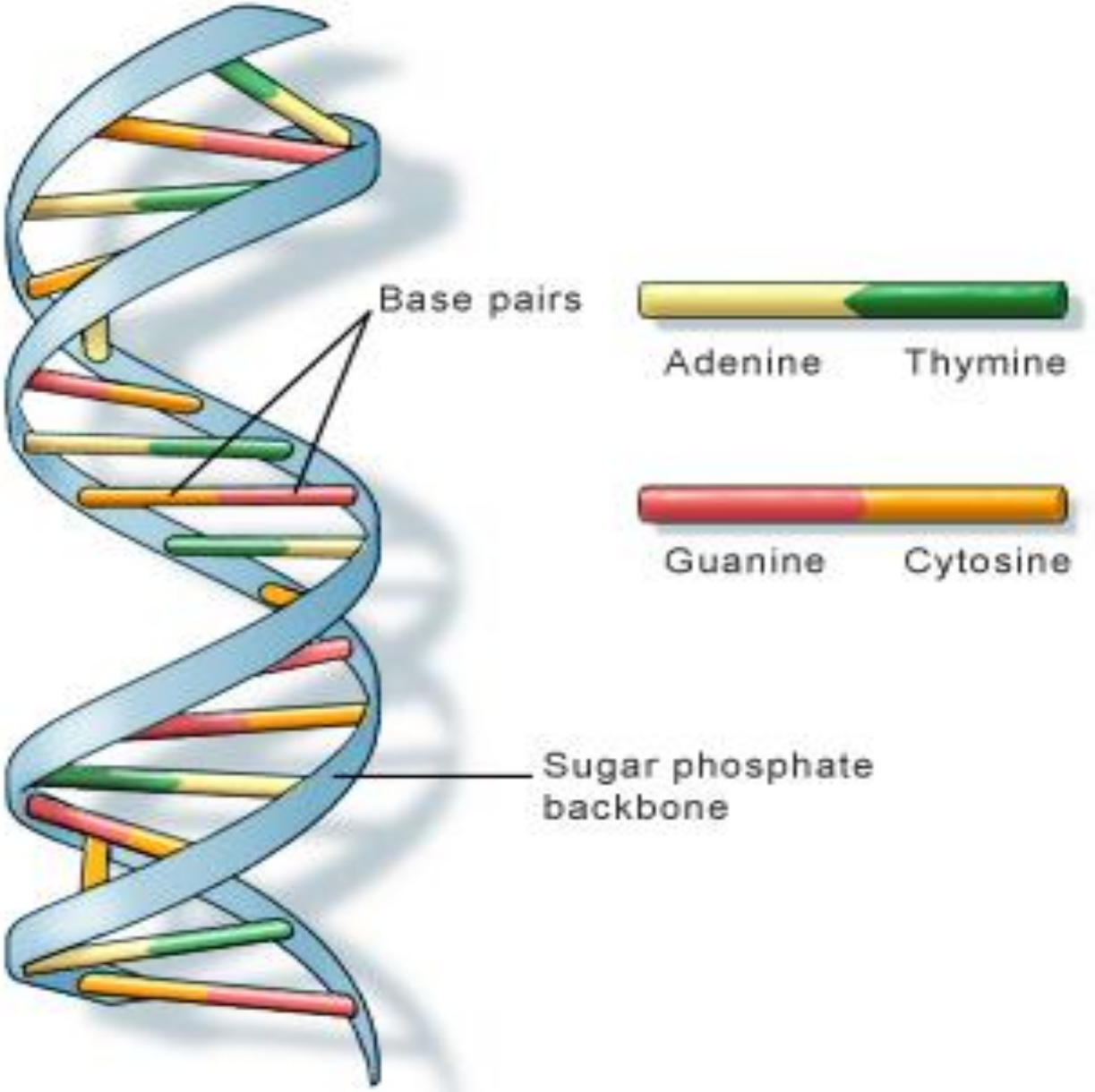
[Make a Molecule of DNA]

Practice Base Pairing Rule

A C T G G A T C A G T C

| | | | | | | | | | | | |

T G A C C T A G T C A G

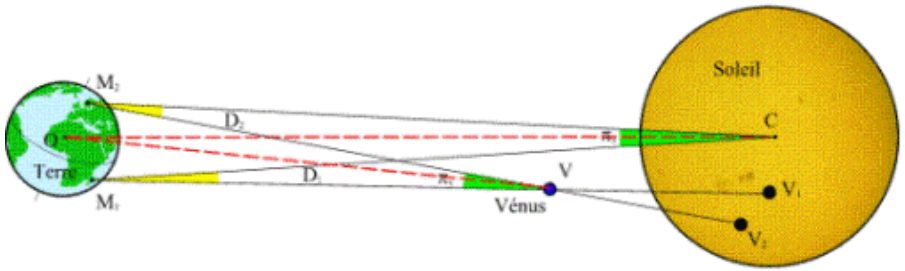


U.S. National Library of Medicine

DNA

- DNA is very long!

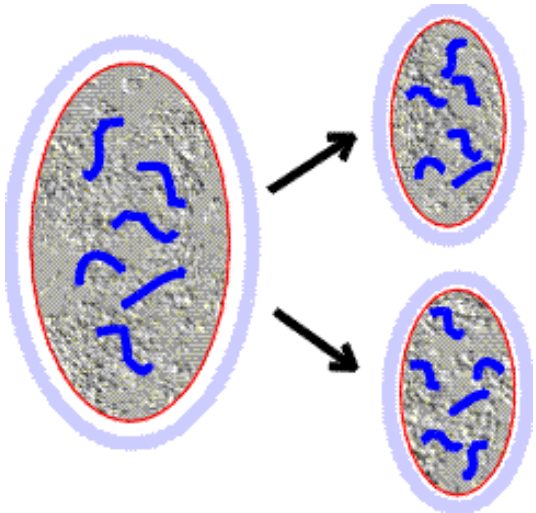
The total length of DNA present in one adult human =
distance from the earth to the sun and back!



Projection dans le plan tangent à la sphère céleste et passant par le centre du Soleil

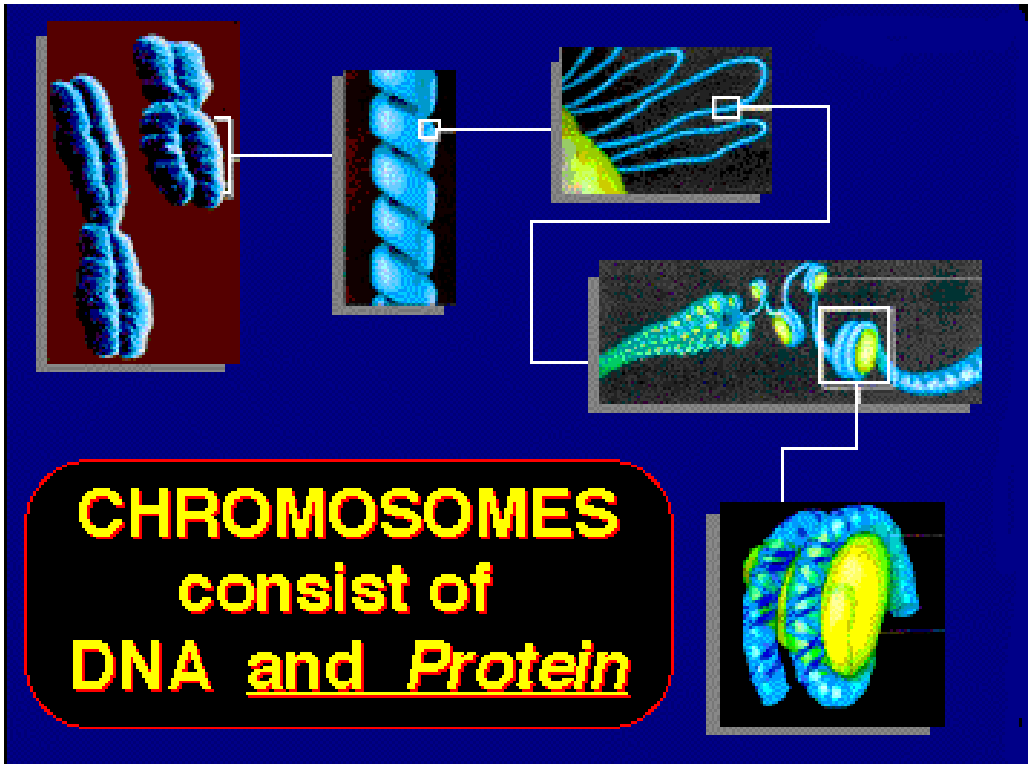
DNA

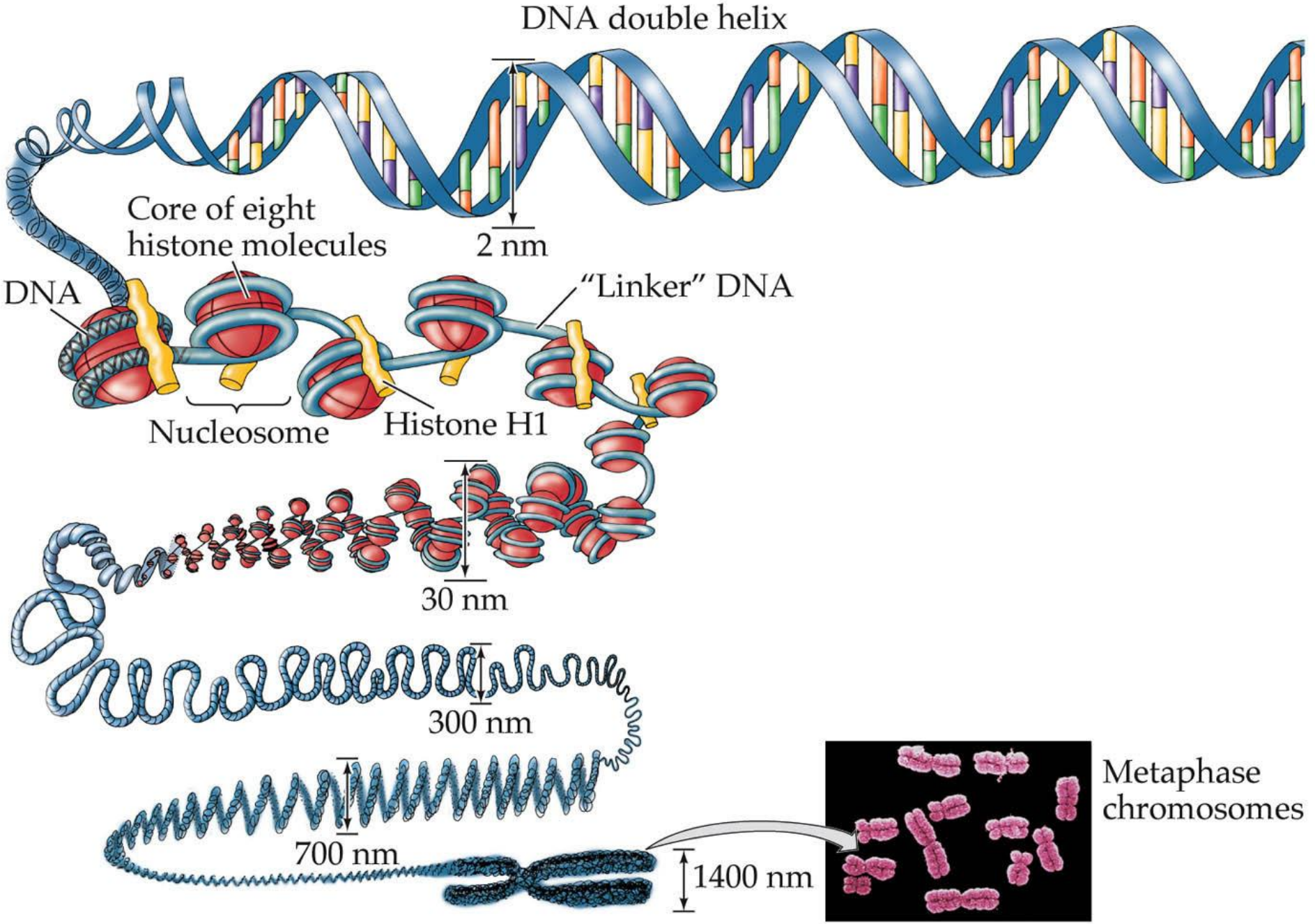
- DNA is found in each single-celled organism and in every cell of a multicelled organism
- Each cell has an exact copy of the DNA
- When the cell divides in 2 both new cells must have a copy of the DNA



Chromosome Structure

- Contain DNA & proteins packed together called Chromatin

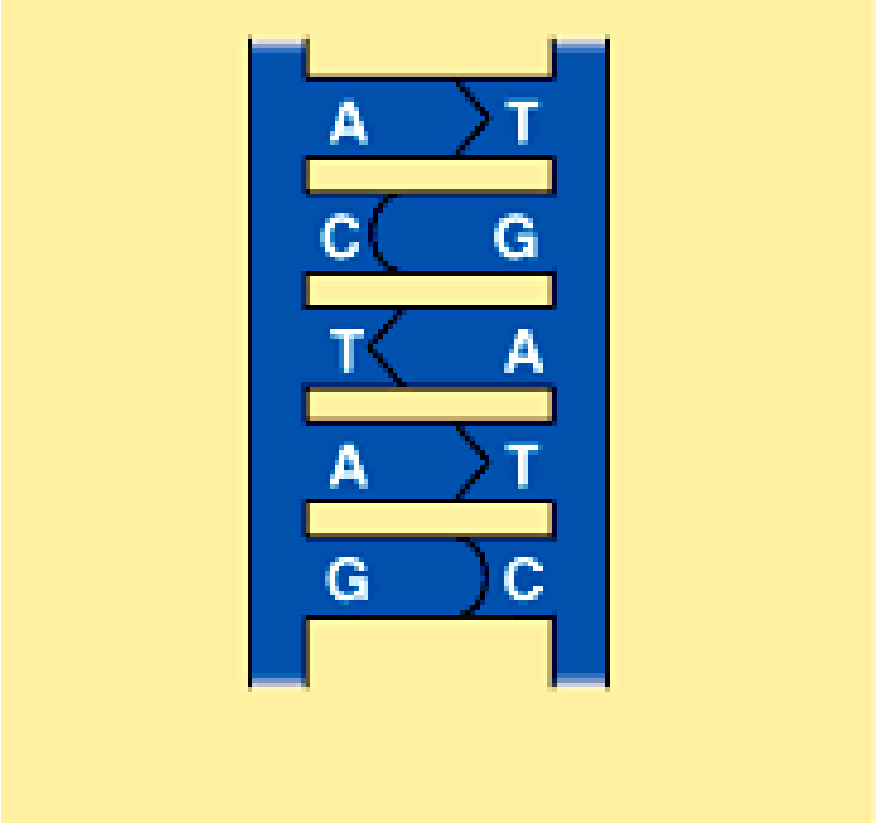




LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.6 DNA Packs into a Mitotic Chromosome**

DNA Replication

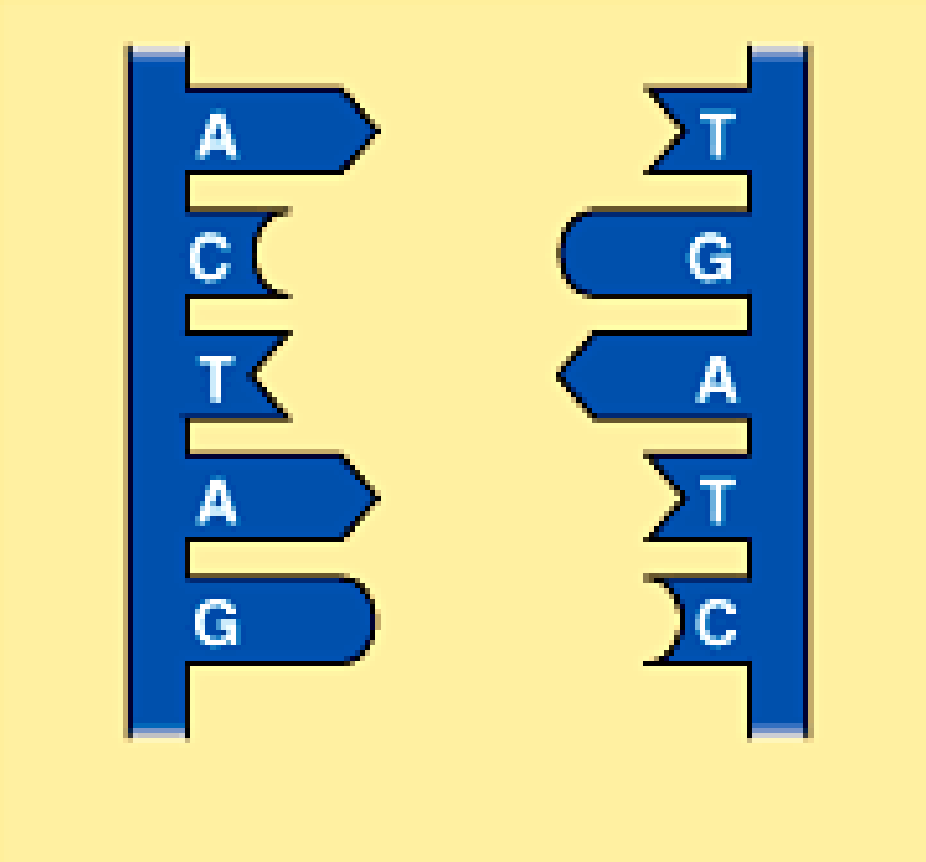
- DNA molecule serves as a pattern or template to make a copy of itself
- Results in 2 exact copies of DNA



DNA Replication

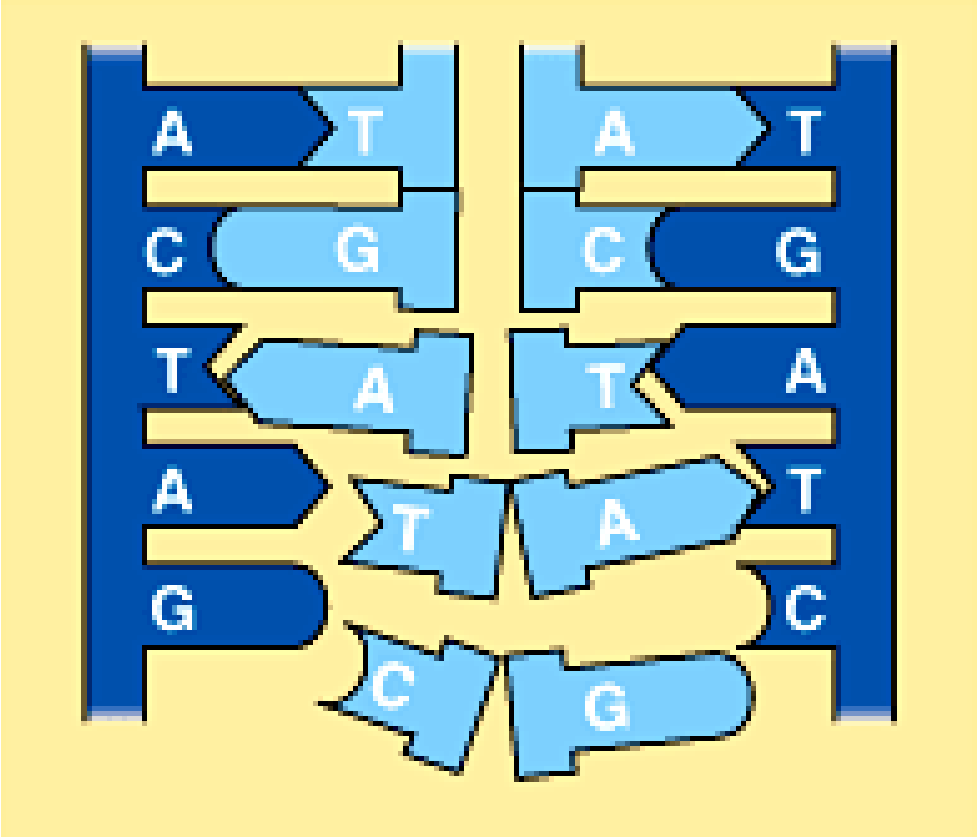
Steps of DNA Replication

1. Unzipping- An enzyme (DNA polymerase) breaks apart the hydogen bonds that hold the bases together



Steps of DNA Replication

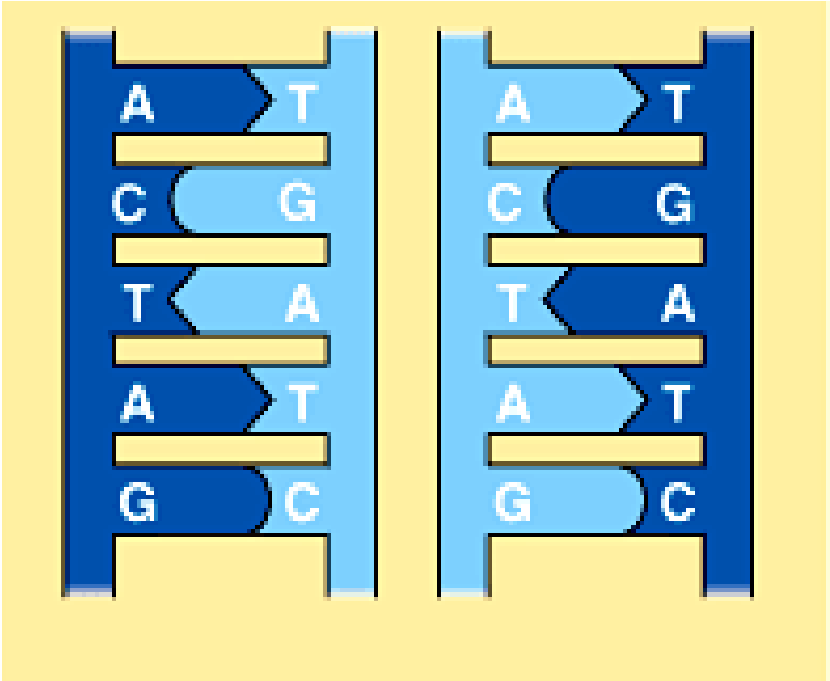
2. New nucleotides are added to both sides of the original strand by the base pairing rule



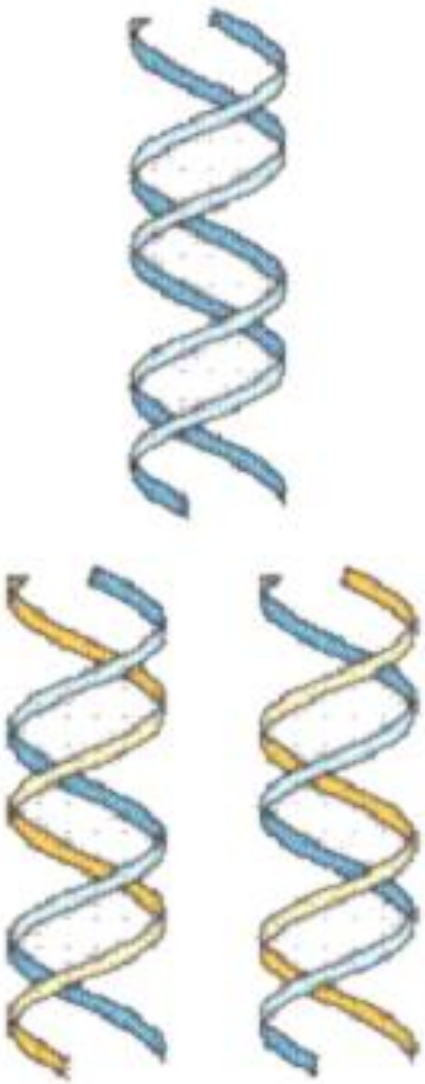
Steps of DNA Replication

3. Process continues until 2 copies of DNA are formed

   - each with 1 original DNA strand and 1 new strand



Semi-Conservative Replication



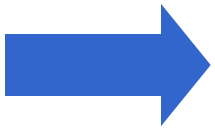
DNA Replication

Practice DNA Replication

1. Add the complementary right side to complete the original strand of DNA
2. Unzip the DNA by copying both the left and right sides of the original strand leaving space between.
3. Using the base pairing rule complete 2 copies of the original strand

Practice DNA Replication

Left Original	Right Original
C-	-G
G-	-C
A-	-T
T-	-A
T-	-A
C-	-G
A-	-T
G-	-C
C-	-G
T-	-A



Left Original	Right New
C-	-G
G-	-C
A-	-T
T-	-A
T-	-A
C-	-G
A-	-T
G-	-C
C-	-G
T-	-A

+

Left New	Right Original
C-	-G
G-	-C
A-	-T
T-	-A
T-	-A
C-	-G
A-	-T
G-	-C
C-	-G
T-	-A