UNIT 6: DNA/RNA/PROTEIN SYNTHESIS

TOPIC 1: DNA HISTORY & STRUCTURE

By the end of this topic, you should be able to…

- *Identify the experiments and scientists involved in the discovery of DNA*
- *Describe the structure of the DNA molecule*

REVIEW ☺

- Define monomer
- Define polymer
- What is the monomer of nucleic acids?
- Who discovered the structure of DNA and what is it's structure?

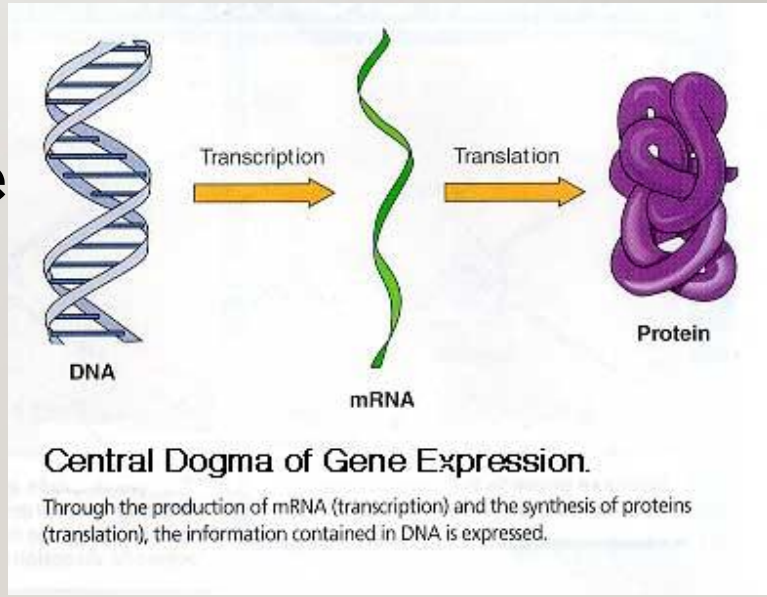
REVIEW ☺

- Define monomer
  - Building block (single unit)
- Define polymer
  - Chain of repeating units
- What is the monomer of nucleic acids?
  - Nucleotide
- Who discovered the structure of DNA and what is it's structure?
  - "Watson & Crick" – double helix

HISTORY OF DNA

HISTORY OF DNA

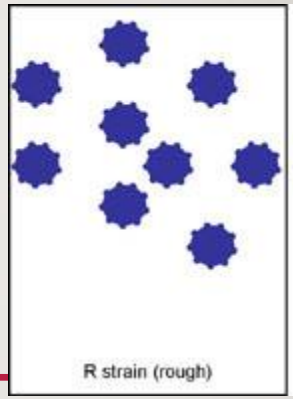
- **Early scientists thought protein was the cell's hereditary material because it was more complex than DNA**
- **Proteins were composed of 20 different amino acids in long polypeptide chains**

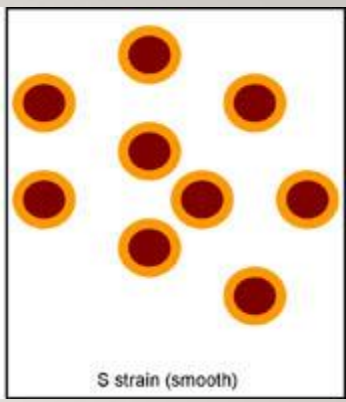


Central Dogma of Gene Expression.

Through the production of mRNA (transcription) and the synthesis of proteins (translation), the information contained in DNA is expressed.

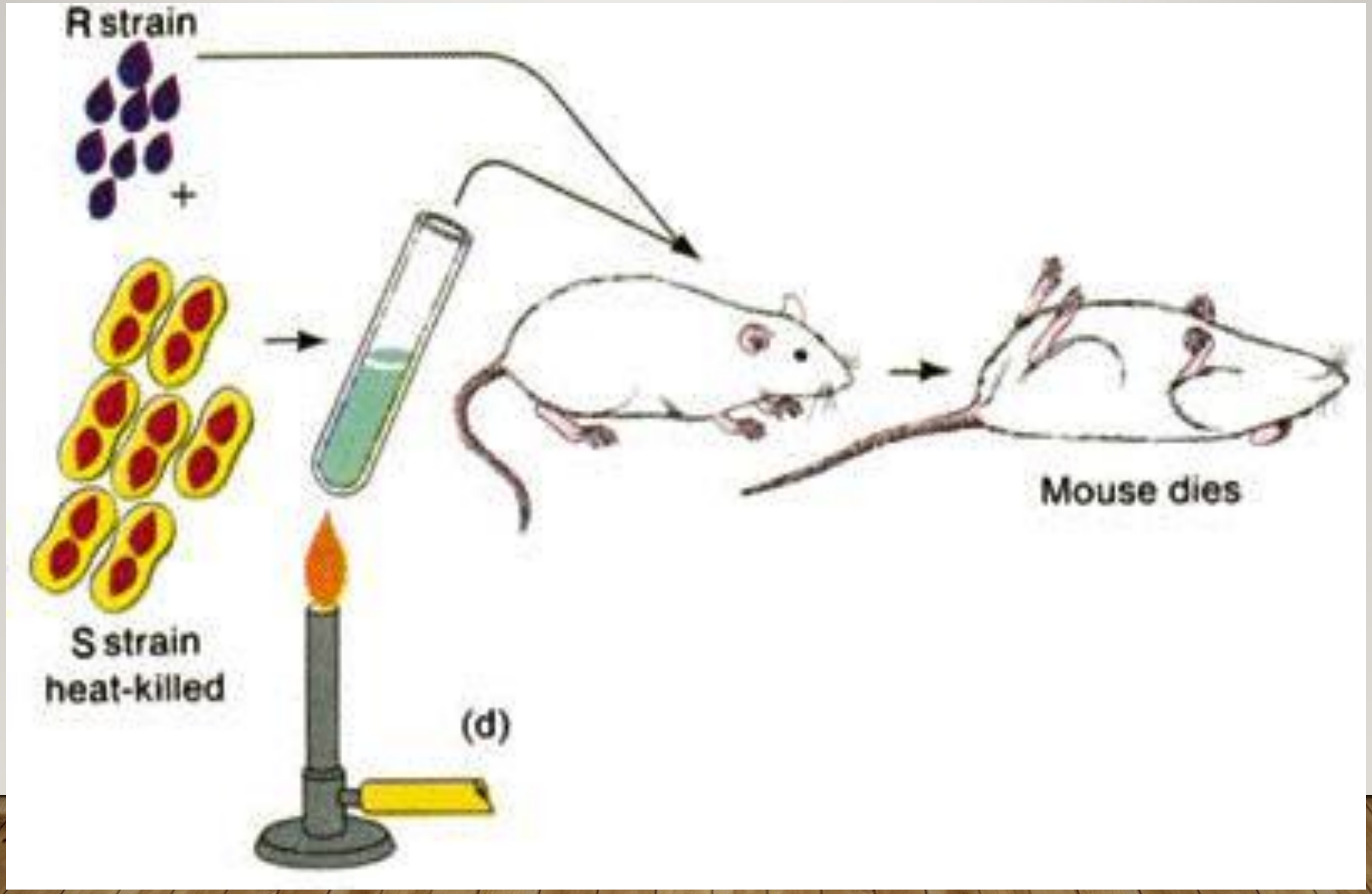
TRANSFORMATION





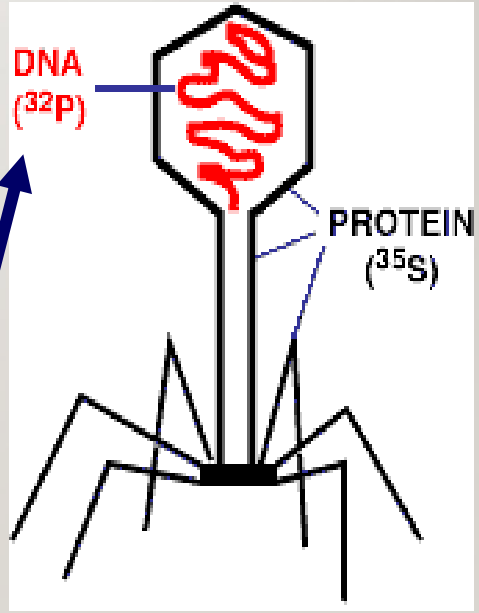
- **Fred Griffith worked with virulent S and nonvirulent R strain pneumonia bacteria**
- **He found that R strain could become virulent when it took in DNA from heat-killed S strain**
- **Study suggested that DNA was probably the genetic material**

GRIFFITH EXPERIMENT



HISTORY OF DNA

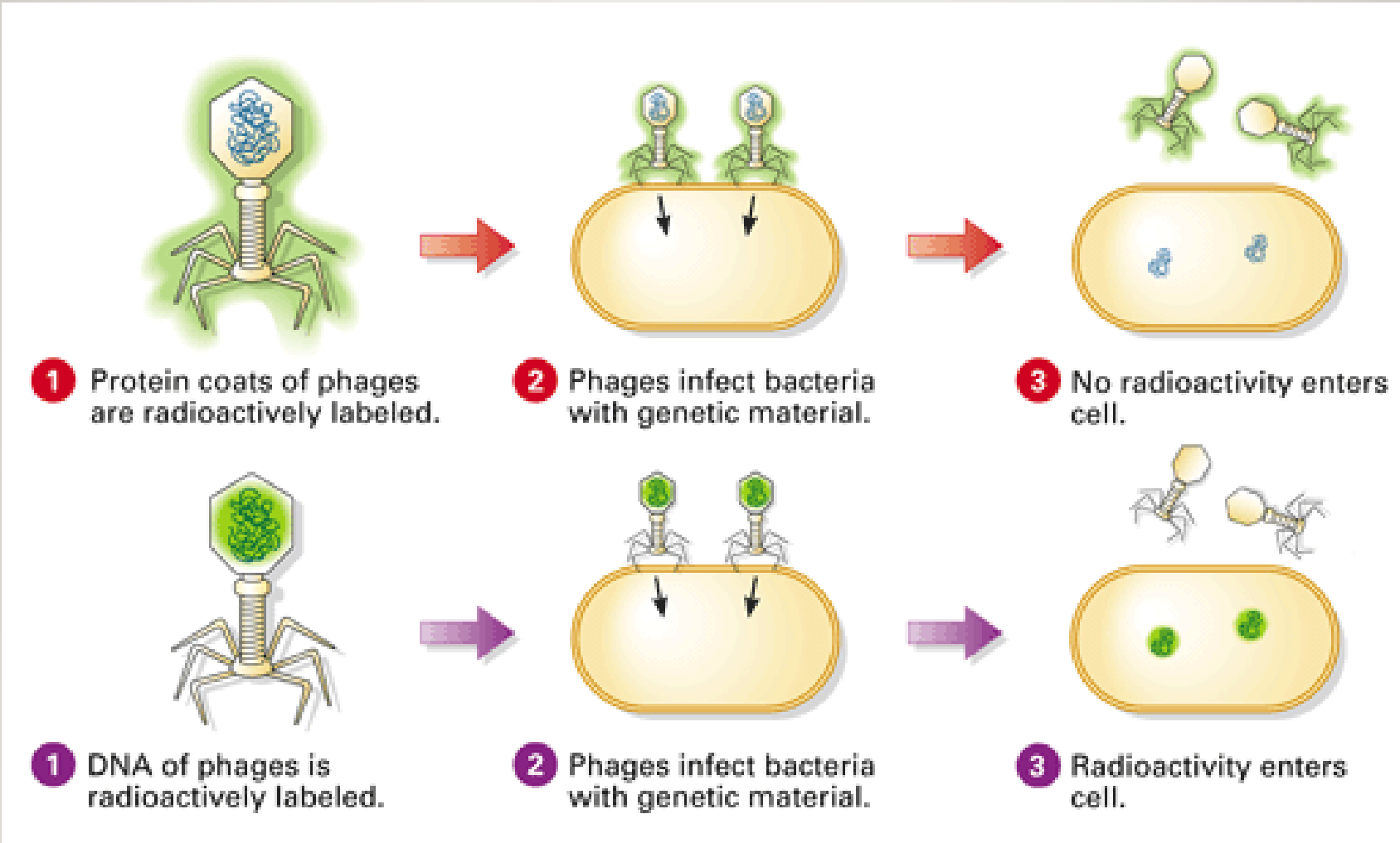
- **Viruses are made of DNA in a protein "coat"**
- **Experiments on viruses by Hershey & Chase proved that DNA was the cell's genetic material**

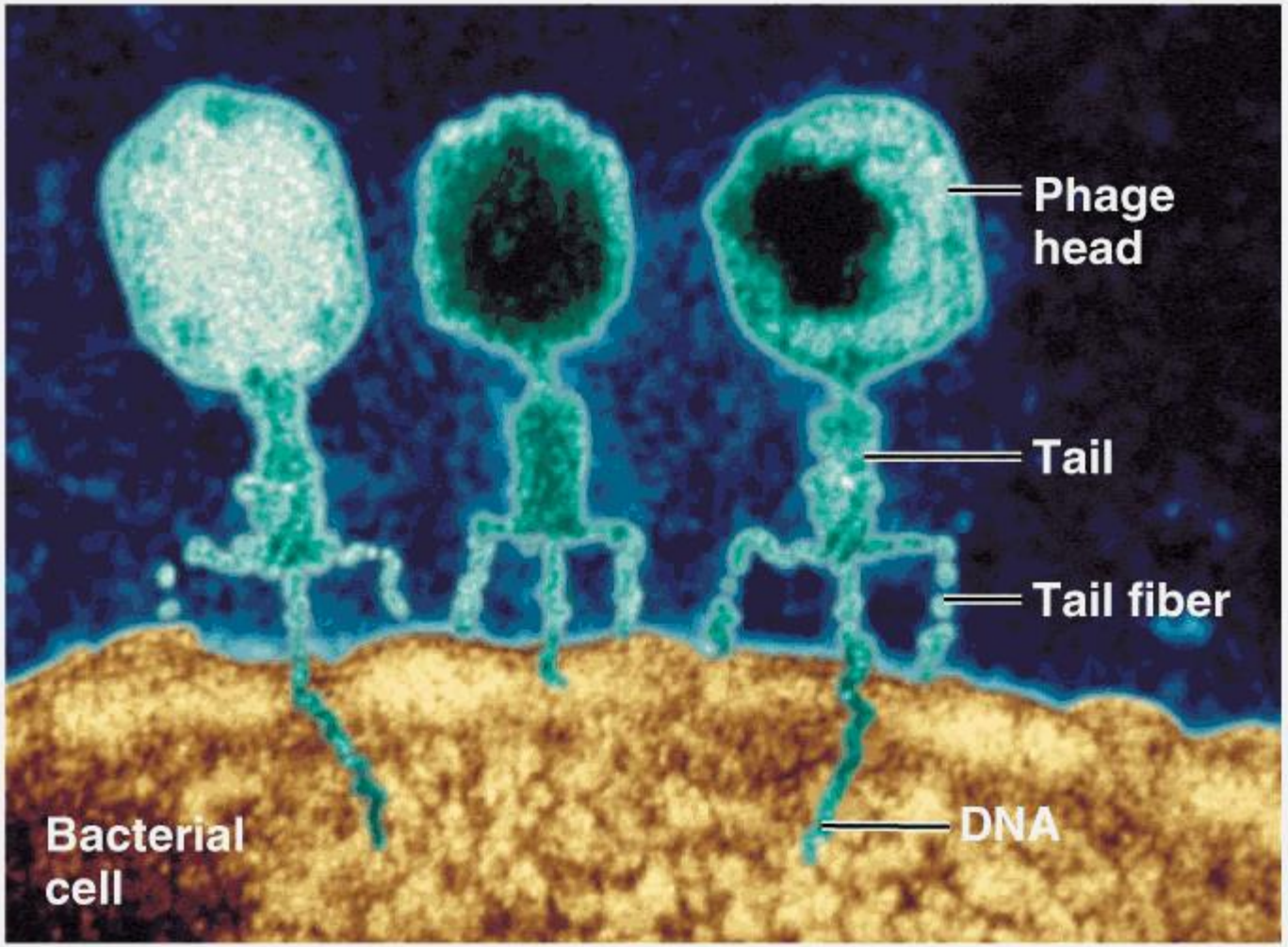


Radioactive DNA was injected into bacteria!

BASICALLY…

- *They used radioactive markers on protein and then DNA. The radioactive DNA was transferred to the bacteria, while the protein was not. They concluded DNA is the hereditary material of the cell.*

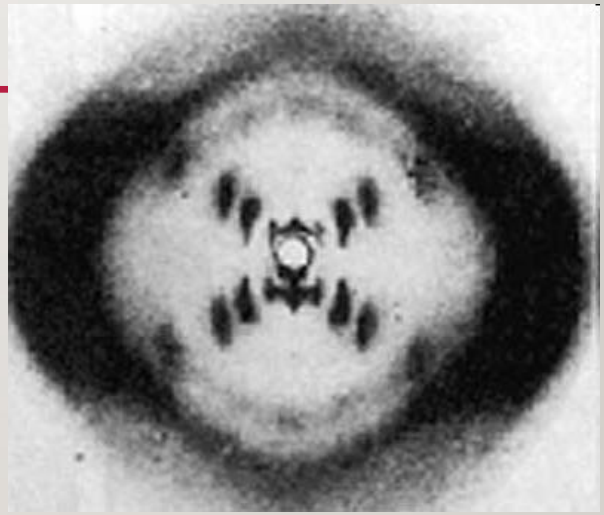

1 Protein coats of phages are radioactively labeled.
2 Phages infect bacteria with genetic material.
3 No radioactivity enters cell.
1 DNA of phages is radioactively labeled.
2 Phages infect bacteria with genetic material.
3 Radioactivity enters cell.



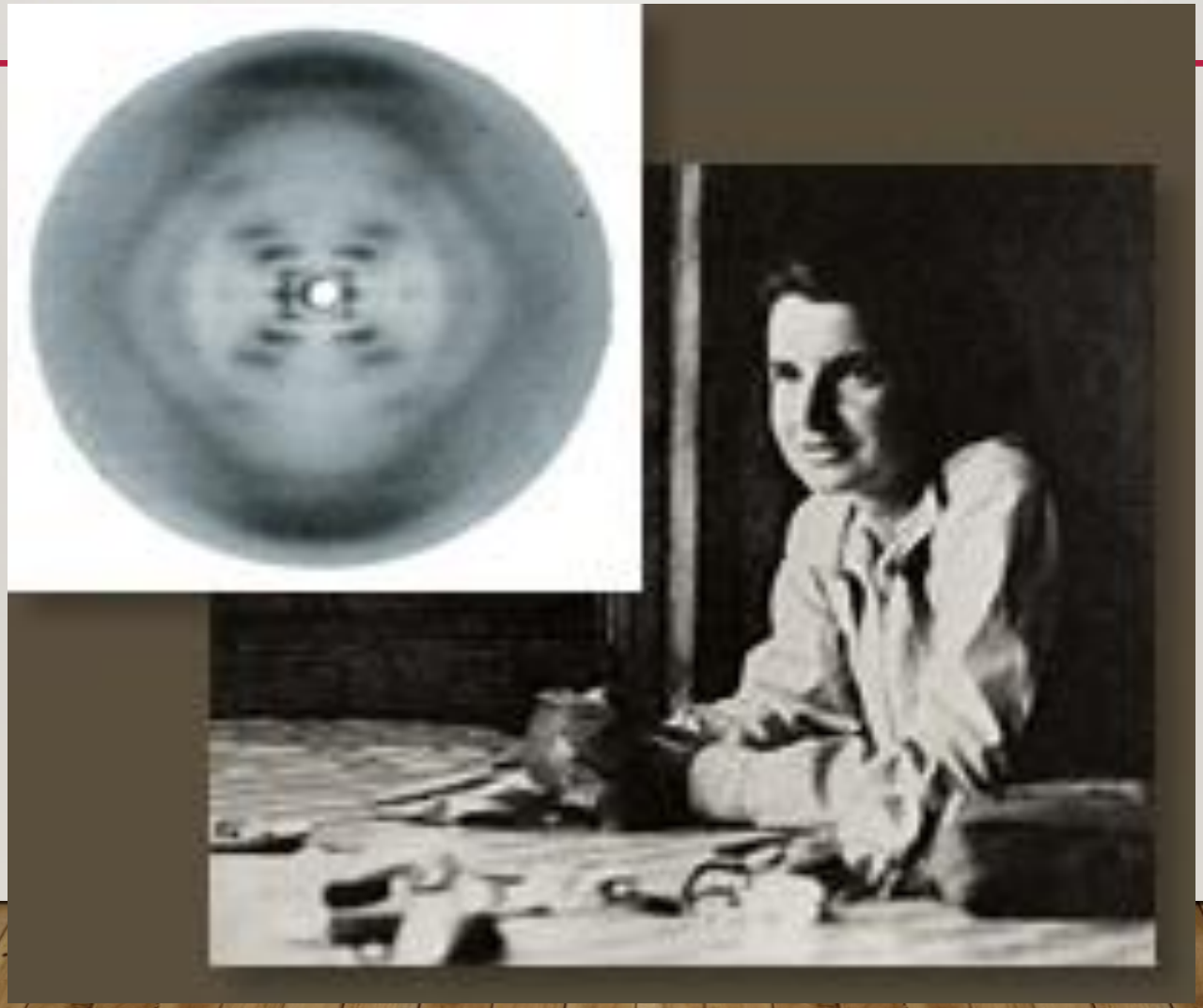
(a) T2 and related phages use their tail pieces to attach to the host cell and inject their genetic material (TEM).

DNA STRUCTURE

- **Rosalind Franklin took diffraction x-ray photographs of DNA crystals**
- **In the 1950's, Watson & Crick built the first model (double helix) of DNA using Franklin's x-rays**



ROSALIND FRANKLIN

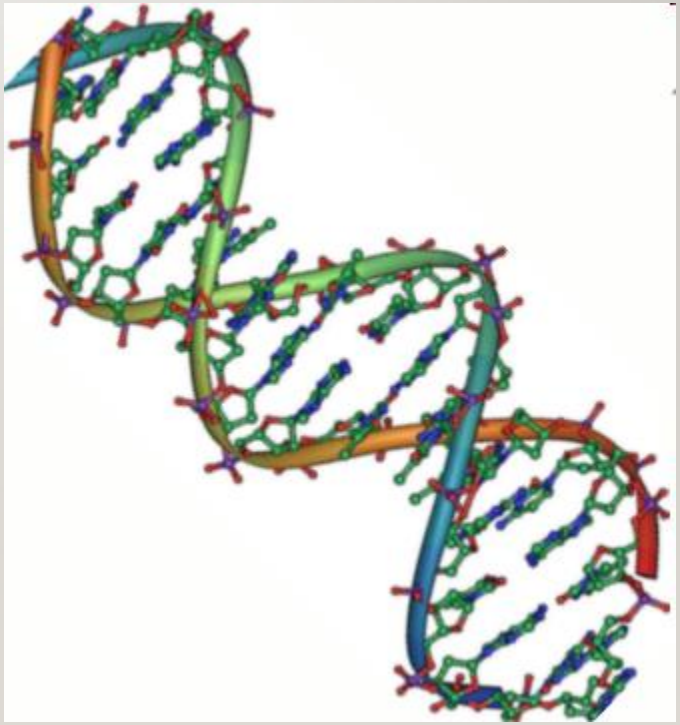


WATSON AND CRICK

DNA STRUCTURE

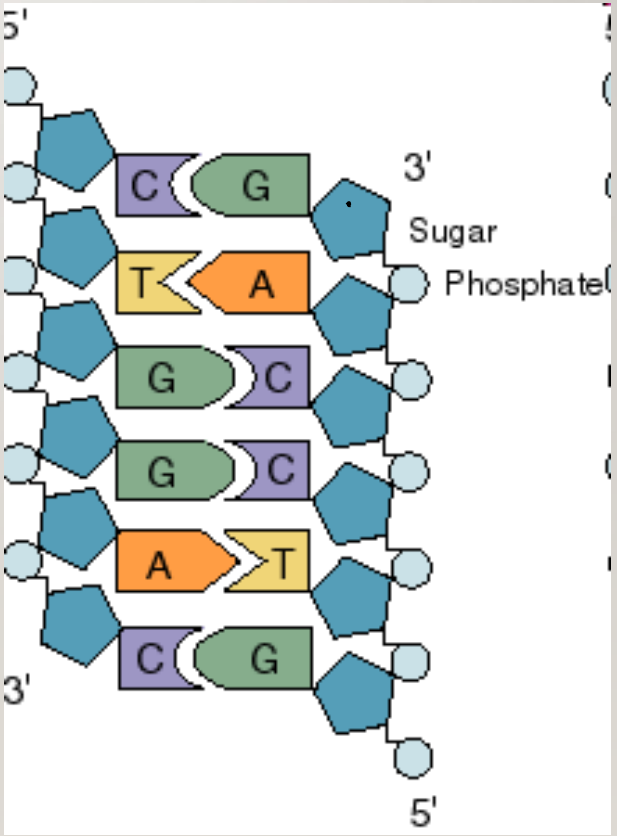
THE BASICS

- **DNA is a type of Nucleic Acid**
- **DNA: Deoxyribonucleic Acid**
- **Made of monomers called nucleotides**
- **Function: to store genetic information**



DNA

- **Two strands coiled called a double helix**
- **Sides made of a sugar Deoxyribose bonded to phosphate (PO_4) groups**
- **Center made of nitrogen bases bonded together by weak hydrogen bonds**



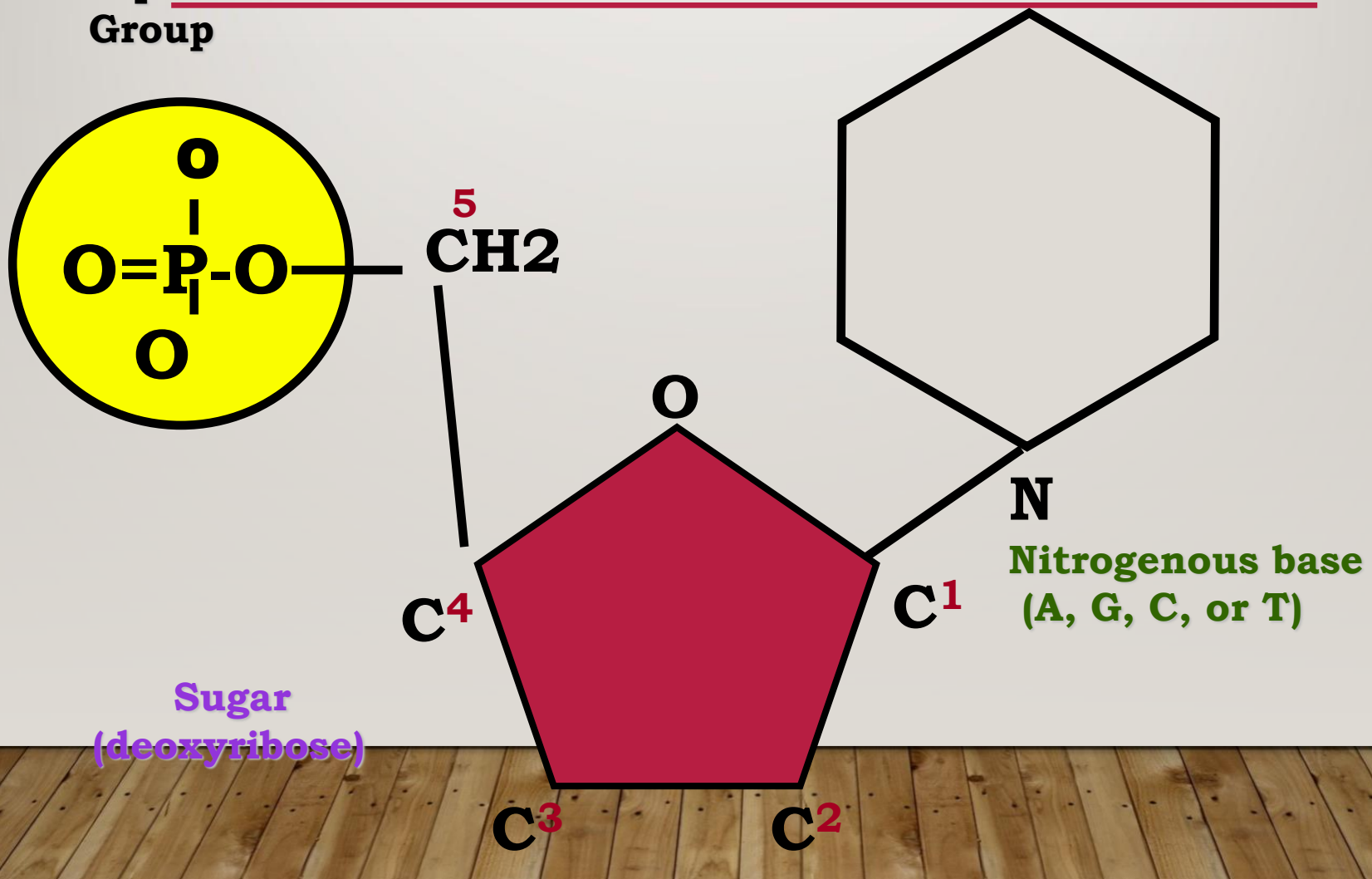
DNA DOUBLE HELIX


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

DNA

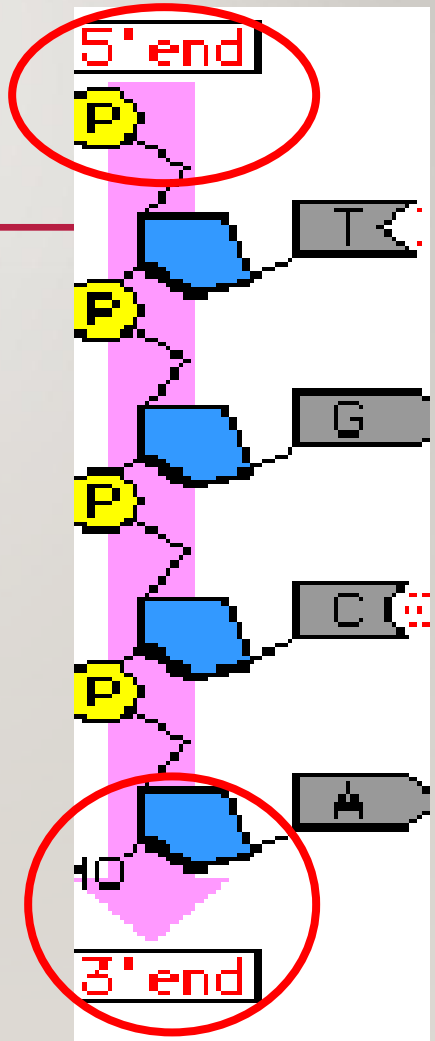
- **Double helix is formed by nucleotides linked to one another**
- **Nucleotide made of:**
  1. **Phosphate group**
  2. **5-carbon sugar**
  3. **Nitrogenous base**

DNA NUCLEOTIDE



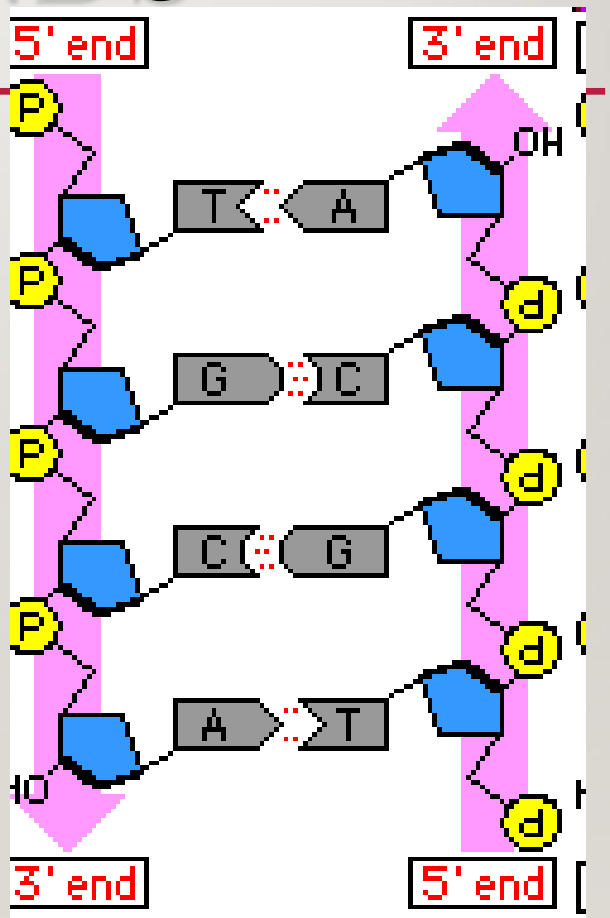
DNA STRANDS

- **The part of a strand that ends with a phosphate group is called the 5 prime (5') end**
- **The part of a strand that ends with a sugar is called the 3 prime (3') end**



ANTIPARALLEL STRANDS

- **One strand of DNA goes from 5’ to 3’**
- **The other strand is opposite in direction going 3’ to 5’**



Strand 1:

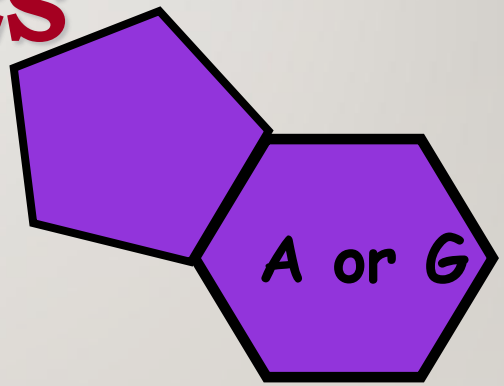
5’ to 3’

Strand 2:

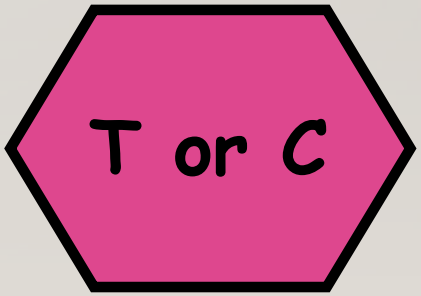
3’ to 5’

NITROGENOUS BASES

- **Double ring PURINES**
  - **Adenine (A)**
  - **Guanine (G)**

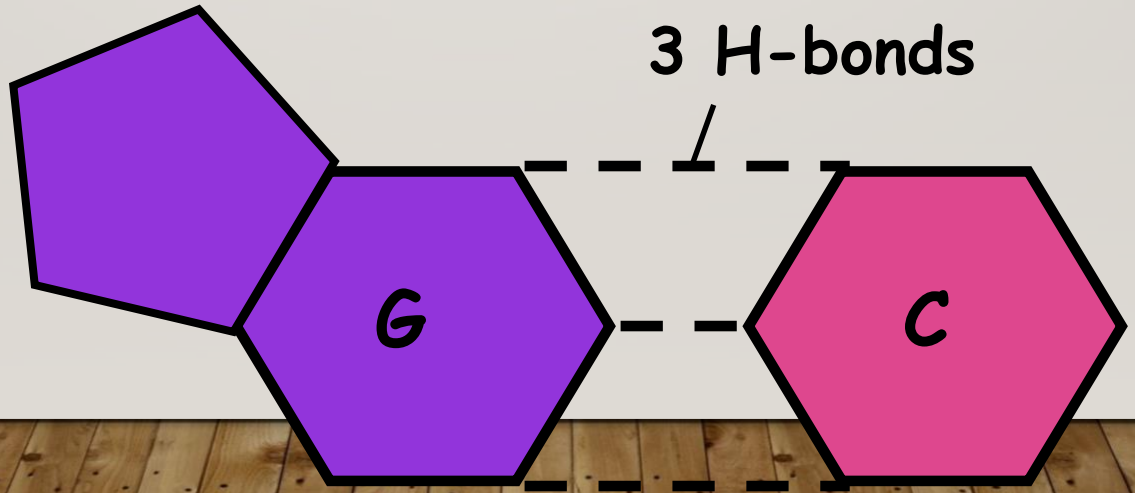


- **Single ring PYRIMIDINES**
  - **Thymine (T)**
  - **Cytosine (C)**

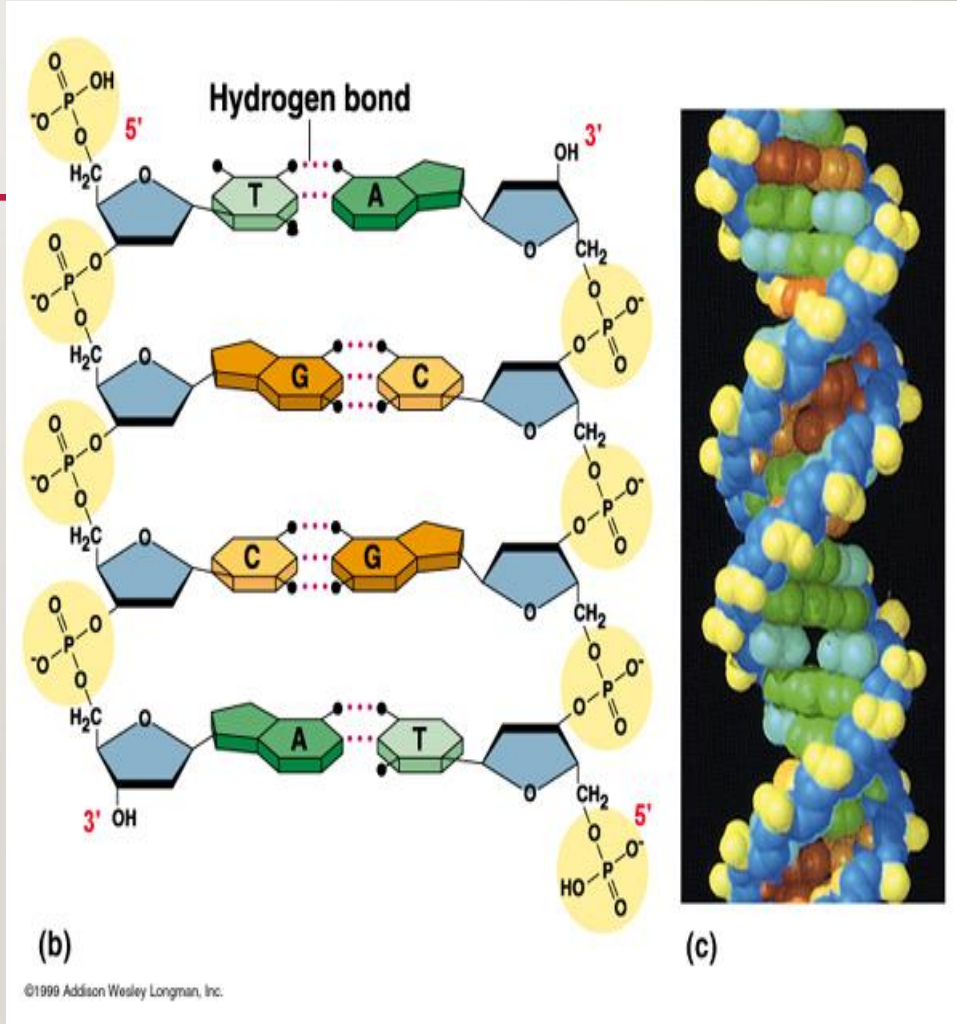


BASE-PAIRINGS

- **Purines only pair with Pyrimidines**
- **Hydrogen bonds connect the bases**

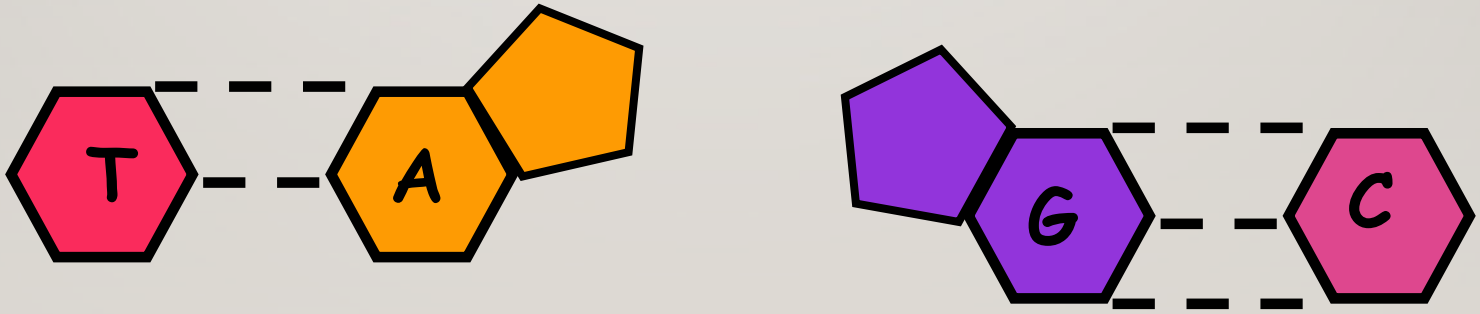


The process of specific bases bonding together to form the rungs of the ladder is called Complementary Base Pairing



CHARGAFF'S RULE

- **Adenine** must pair with **Thymine**
- **Guanine** must pair with **Cytosine**



DISCOVERY OF DNA STRUCTURE

- **Erwin Chargaff showed the amounts of the four bases on DNA (A,T,C,G)**
- **In a body or somatic cell:**

  A = 30.3%

  T = 30.3%

  G = 19.5%

  C = 19.9%

QUESTION:

- **If there is 30% Adenine, how much Cytosine is present?**

ANSWER:

- **There would be 20% Cytosine**
- **Adenine (30%) = Thymine (30%)**
- **Guanine (20%) = Cytosine (20%)**
- **Therefore, 60% A-T and 40% C-G**

QUESTION

Write out the sequence of a strand complementary to the following strand…

T T A G C A T G G

ANSWER

Original Strand: **T T A G C A T G G**

Complementary Strand: **A A T C G T A C C**