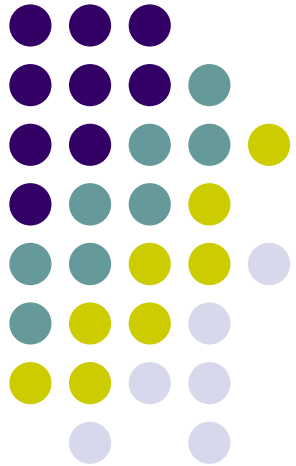
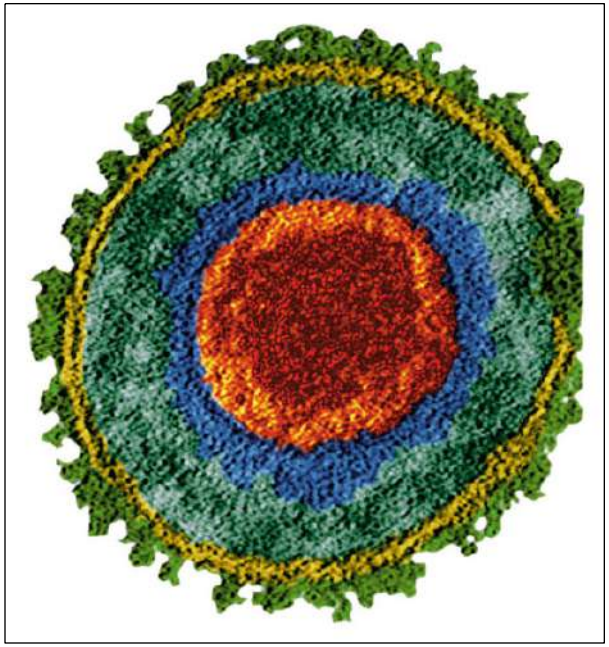
Molecular Biology of the Gene

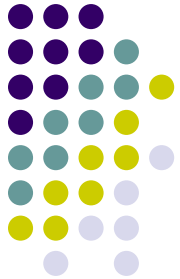
- Chapter 10



- Viruses are biological saboteurs
  - Hijacking the genetic material of host cells in order to reproduce themselves
- Viruses provided some of the earliest evidence
  - That genes are made of DNA

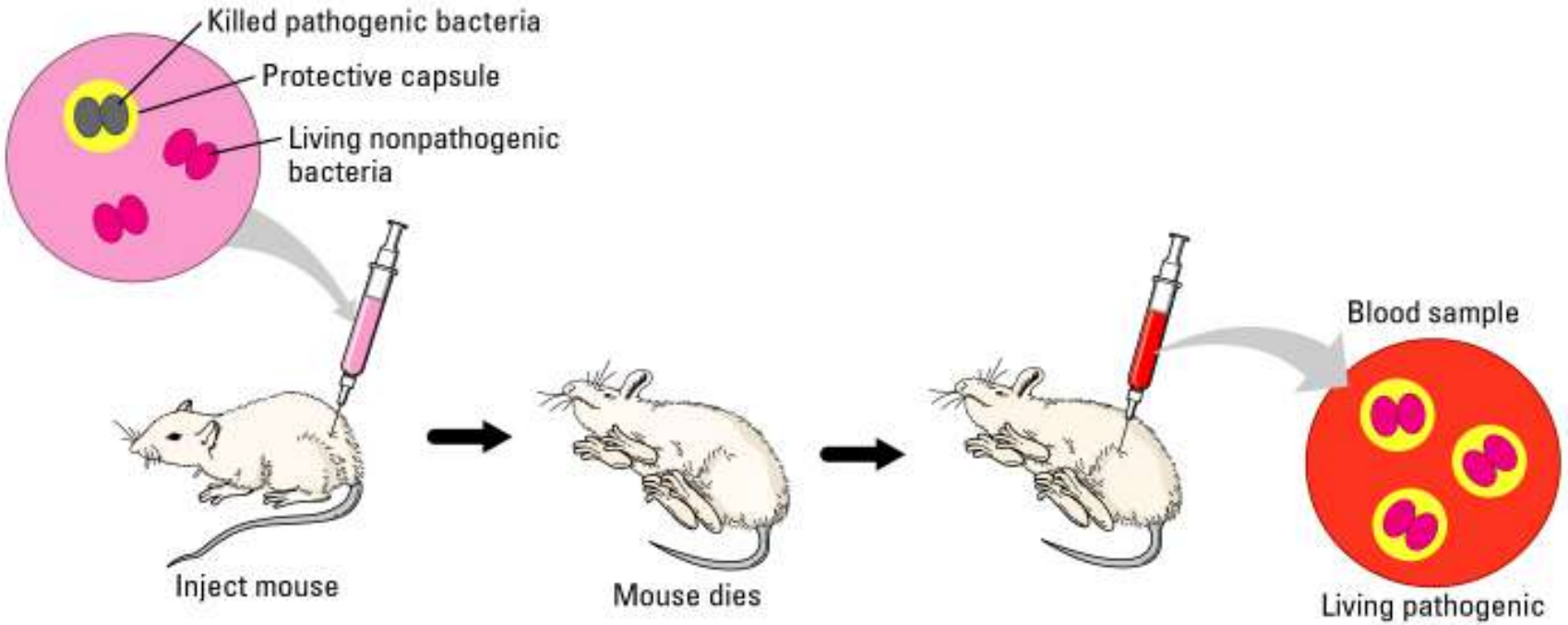


Griffith Discovers Transformation



- 1928
- Attempting to develop a vaccine he isolated two strains of pneumonia
  - Rough strain was harmless
  - Smooth strain was pathogenic

Griffith Discovers Transformation



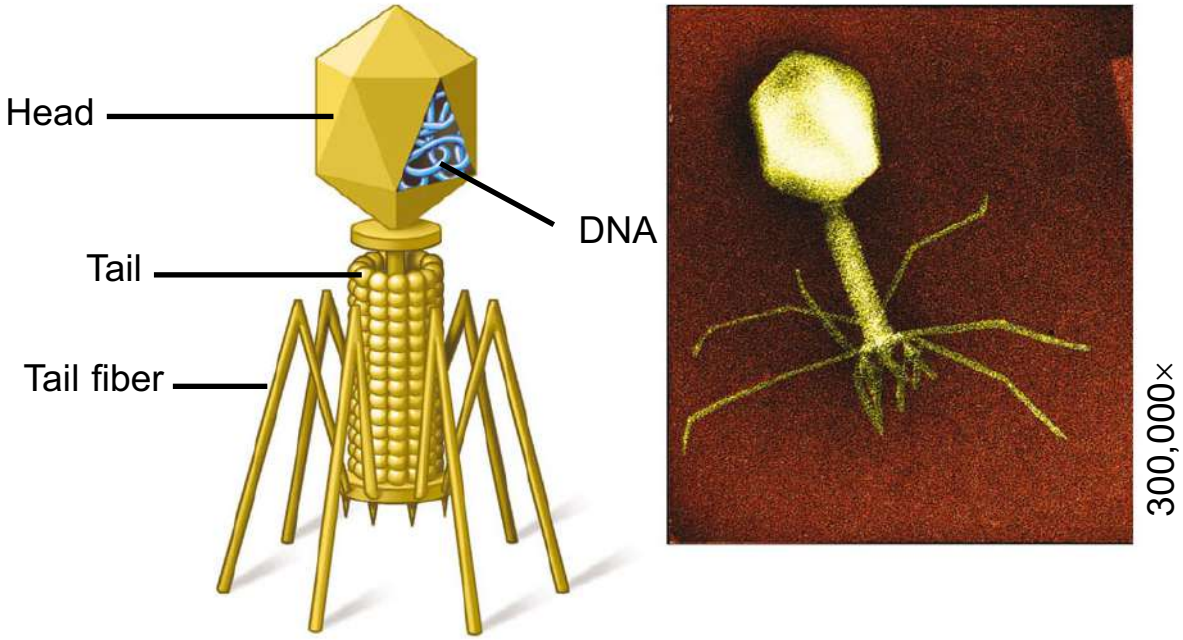
Transformation

- The harmless R cells had been *transformed* by material from the dead S cells

- Descendents of the transformed cells were also pathogenic

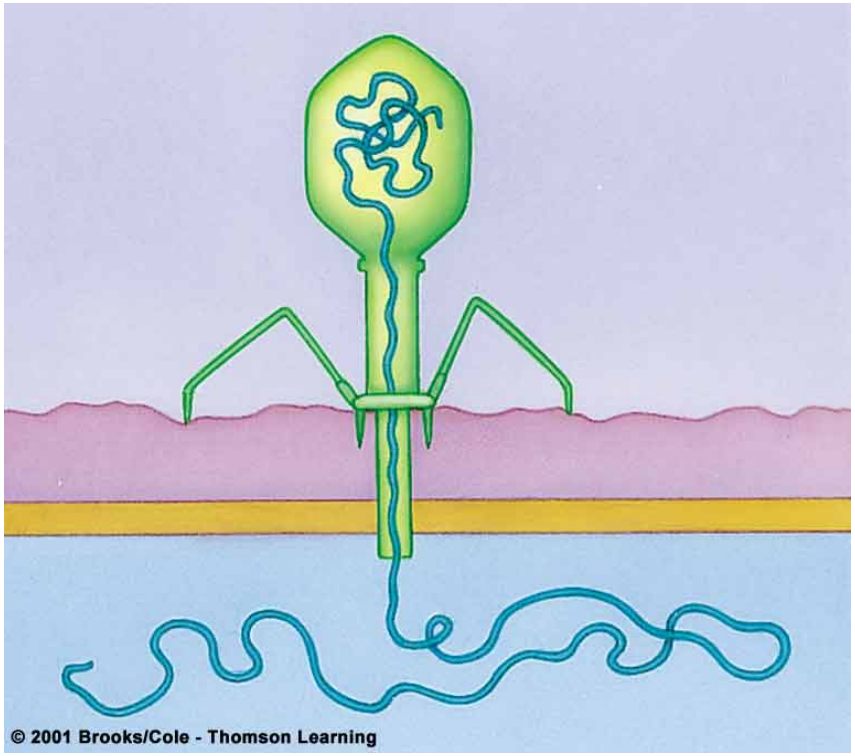
10.1 Experiments showed that DNA is the genetic material

- The Hershey-Chase experiment showed that certain viruses reprogram host cells
  - To produce more viruses by injecting their DNA

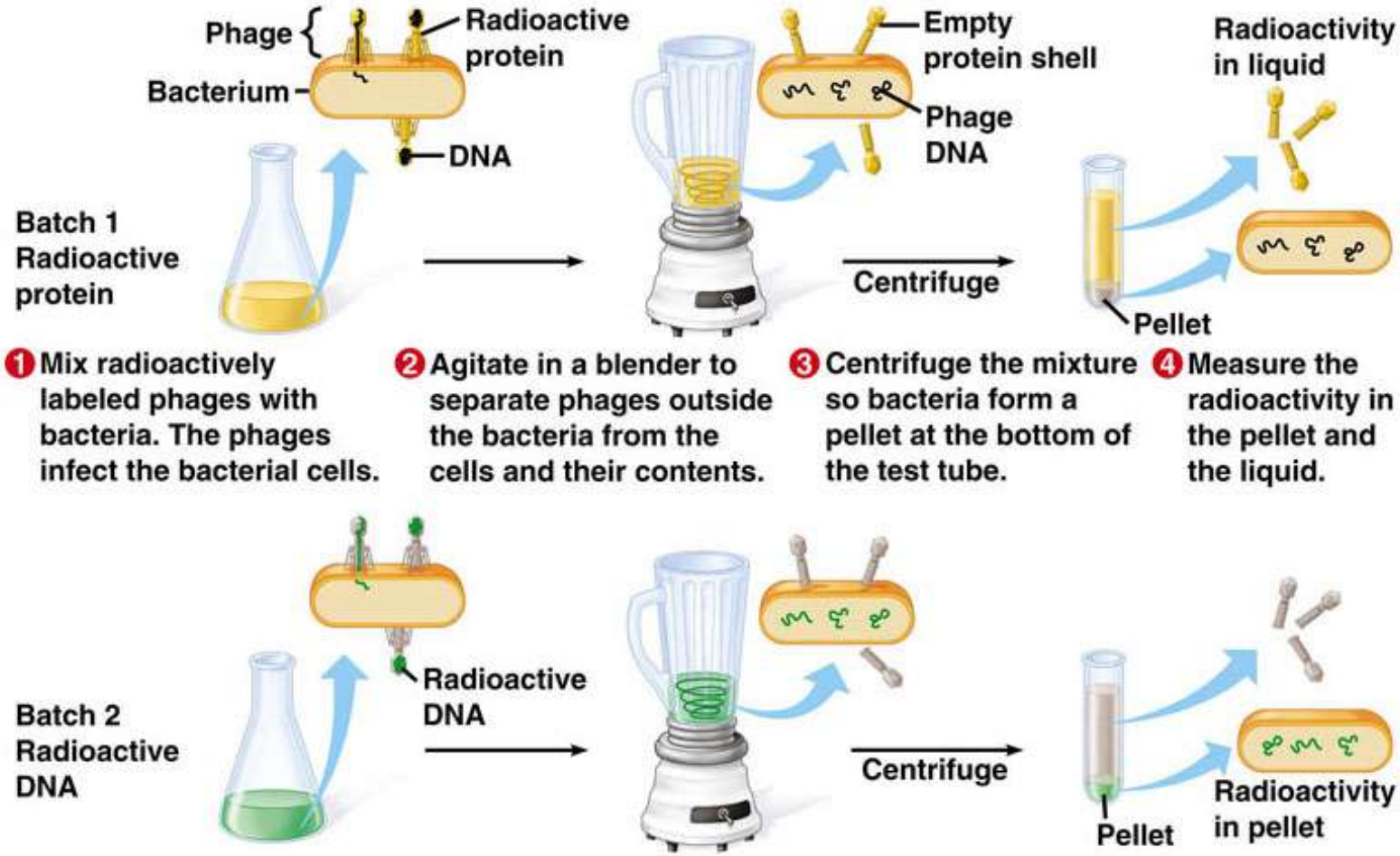


Bacteriophages

- Viruses that infect bacteria
- Consist of protein and DNA
- Inject their hereditary material into bacteria

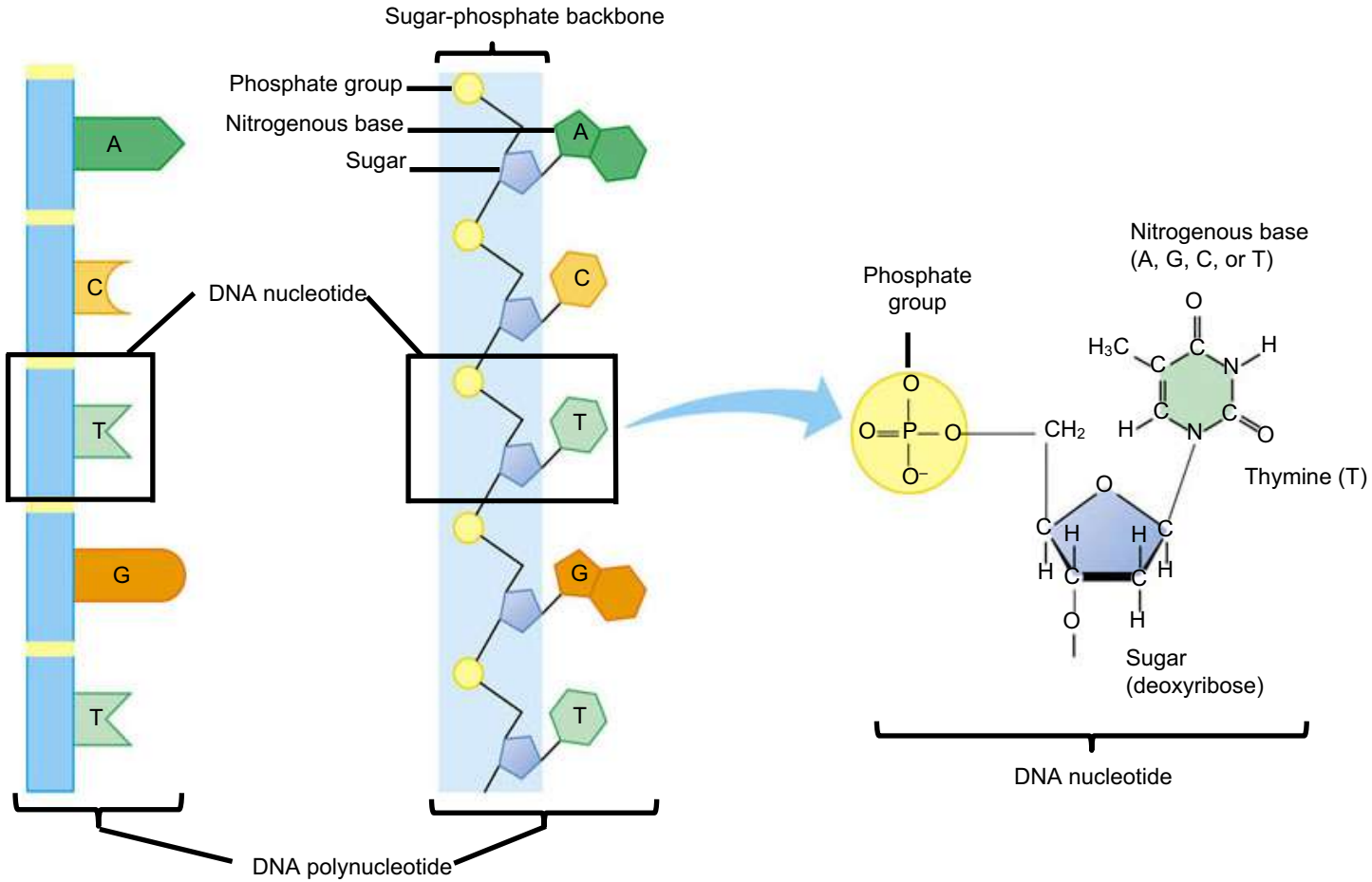


The Hershey-Chase experiment

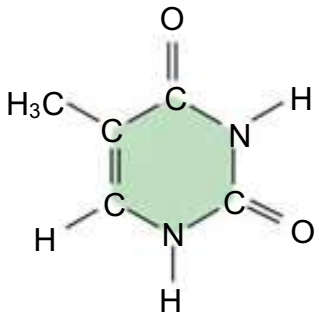


10.2 DNA and RNA are polymers of nucleotides

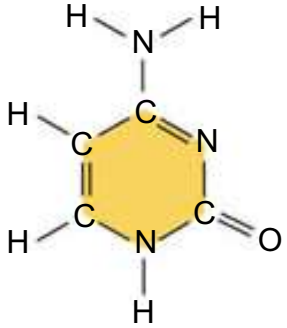
- DNA is a nucleic acid
  - Made of long chains of nucleotide monomers



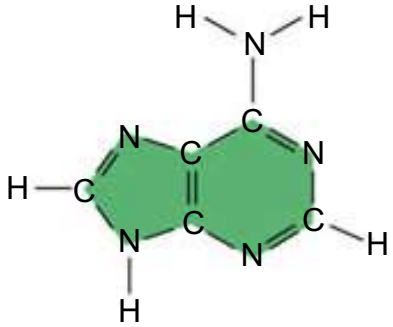
DNA has four kinds of nitrogenous bases A, T, C, and G



Thymine (T)



Cytosine (C)



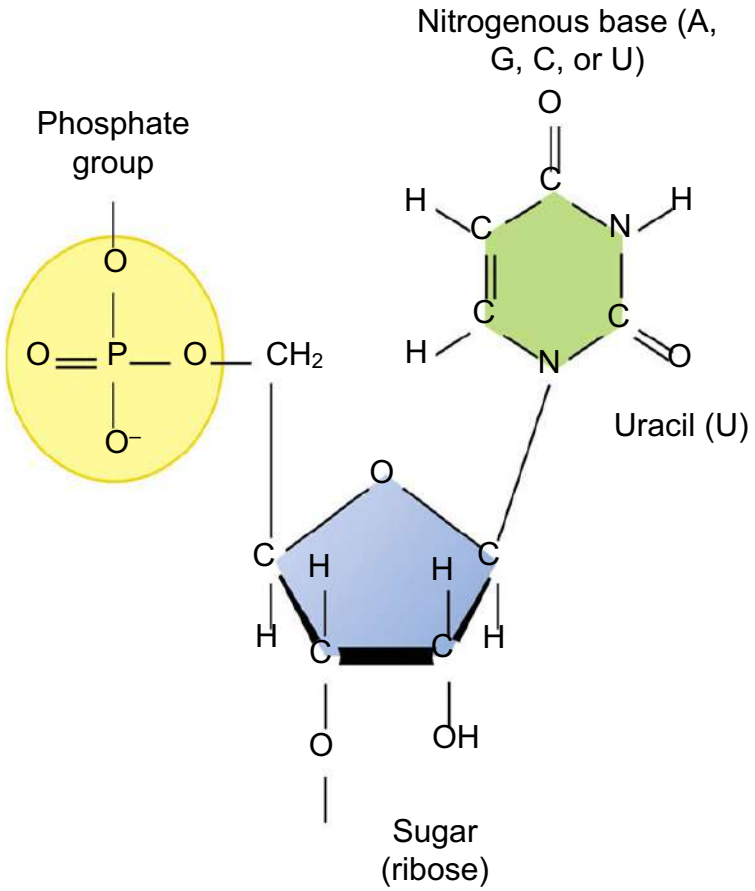
Adenine (A)

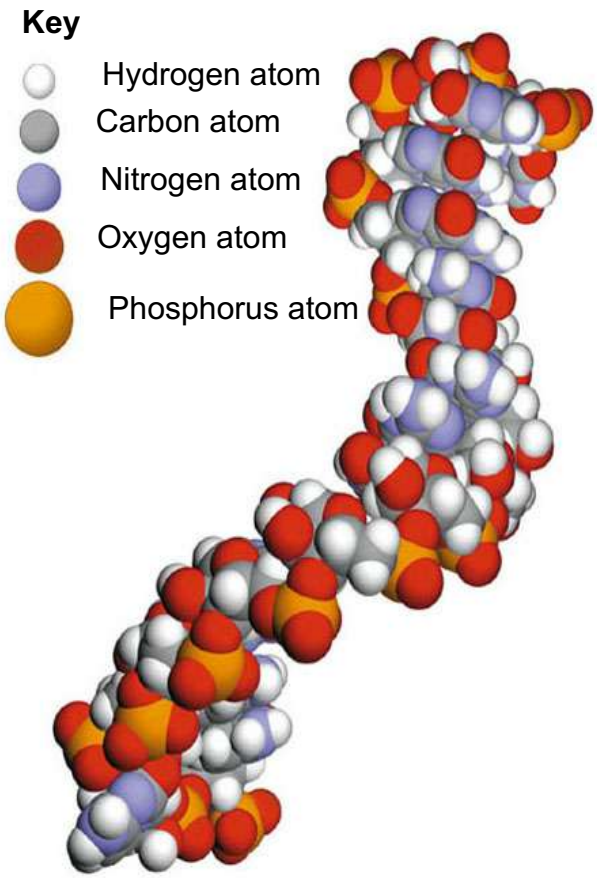
Guanine (G)

Pyrimidines

Purines

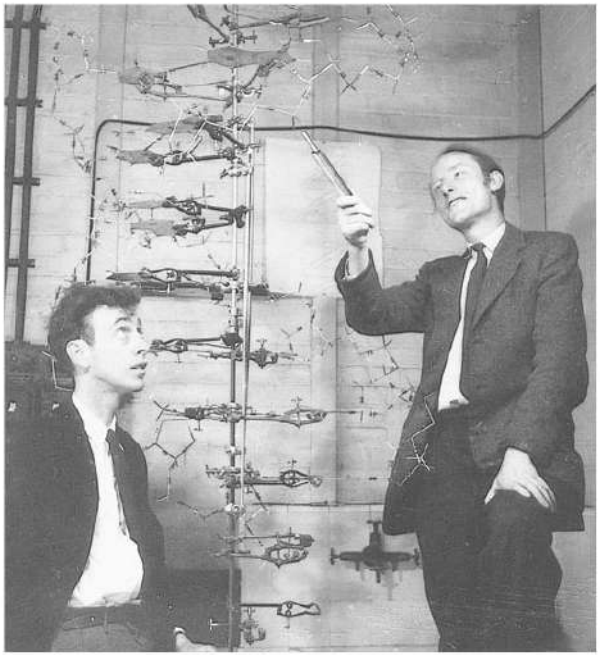
- # RNA is also a nucleic acid
  ## But has a slightly different sugar
  ## And has U instead of T



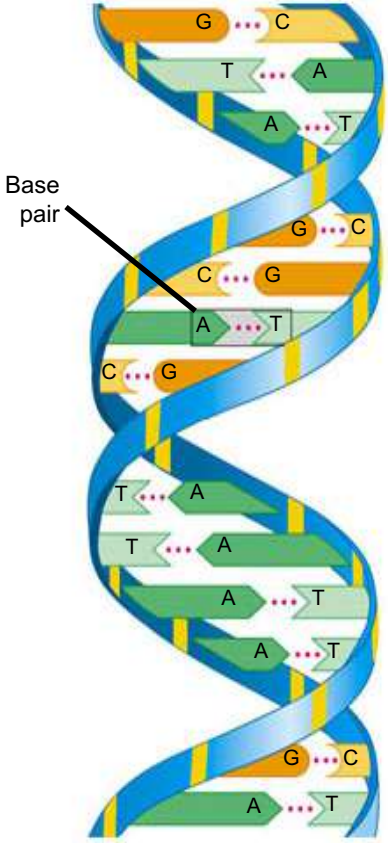


DNA is a double-stranded helix

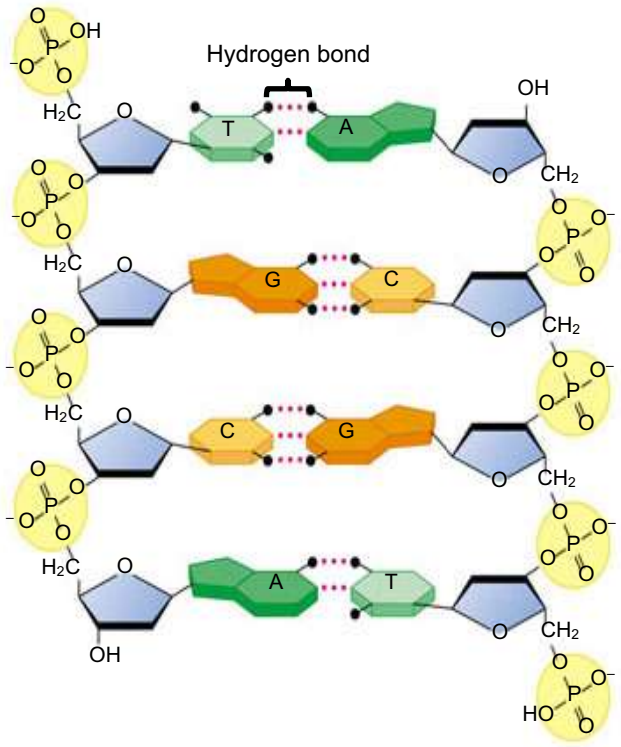
- James Watson and Francis Crick
  - Worked out the three-dimensional structure of DNA, based on work by Rosalind



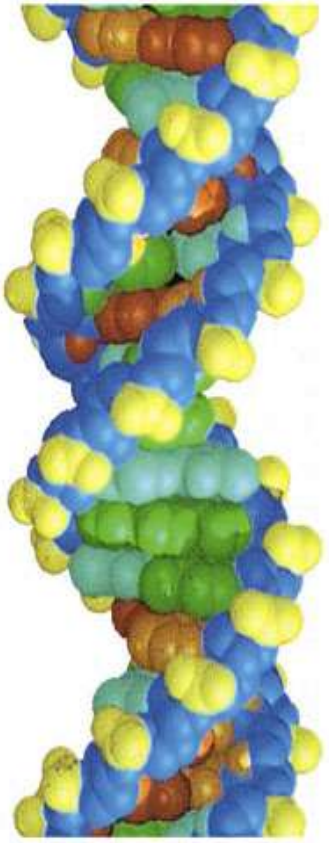
Hydrogen bonds between bases
Hold the strands together
Each base pairs with a complementary partner
A with T, and G with C



Ribbon model

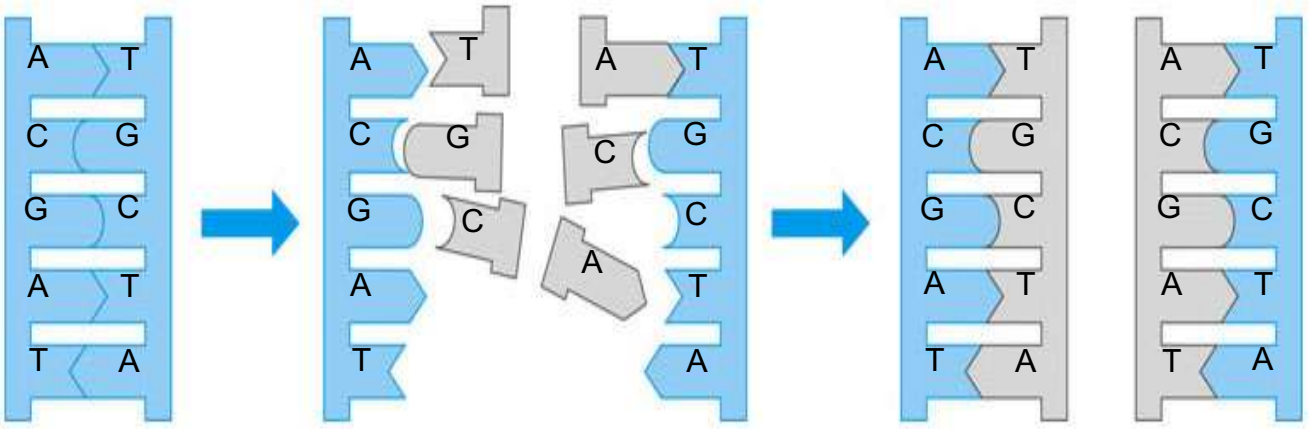


Partial chemical structure


Computer model

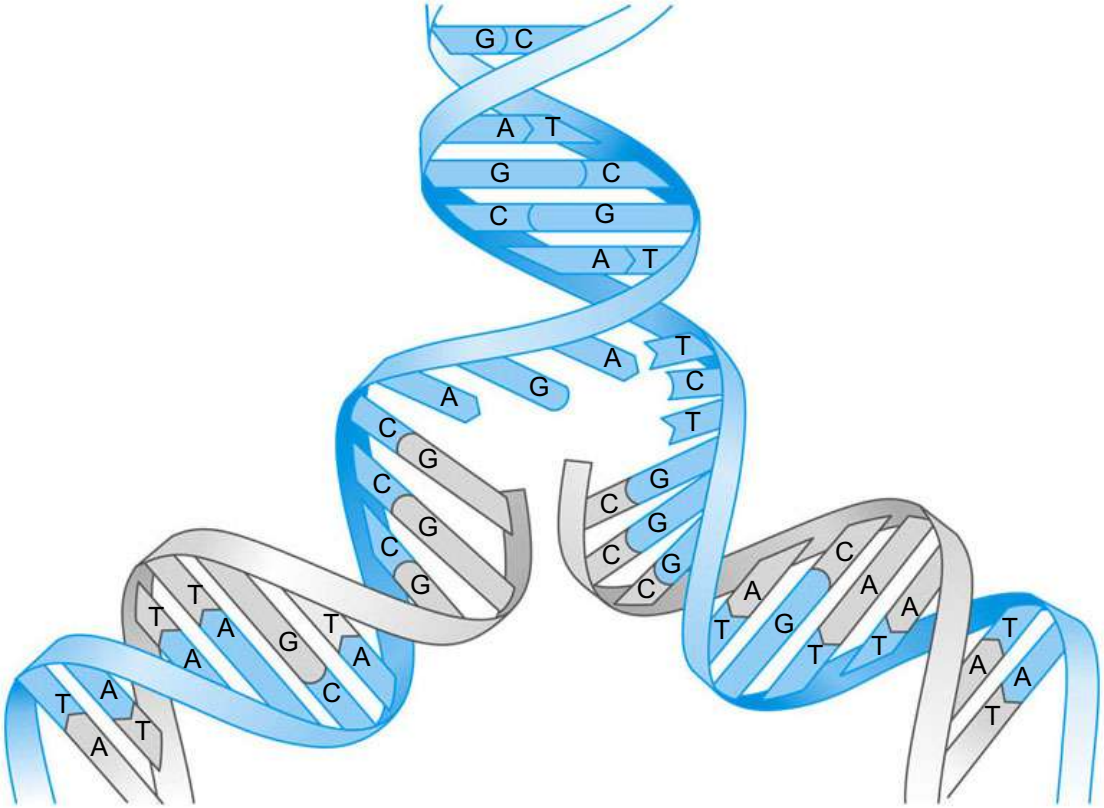
DNA Replication

- DNA replication depends on specific base pairing
  - DNA replication
    - Starts with the separation of DNA strands
  - Then enzymes use each strand as a template
    - To assemble new nucleotides into complementary strands



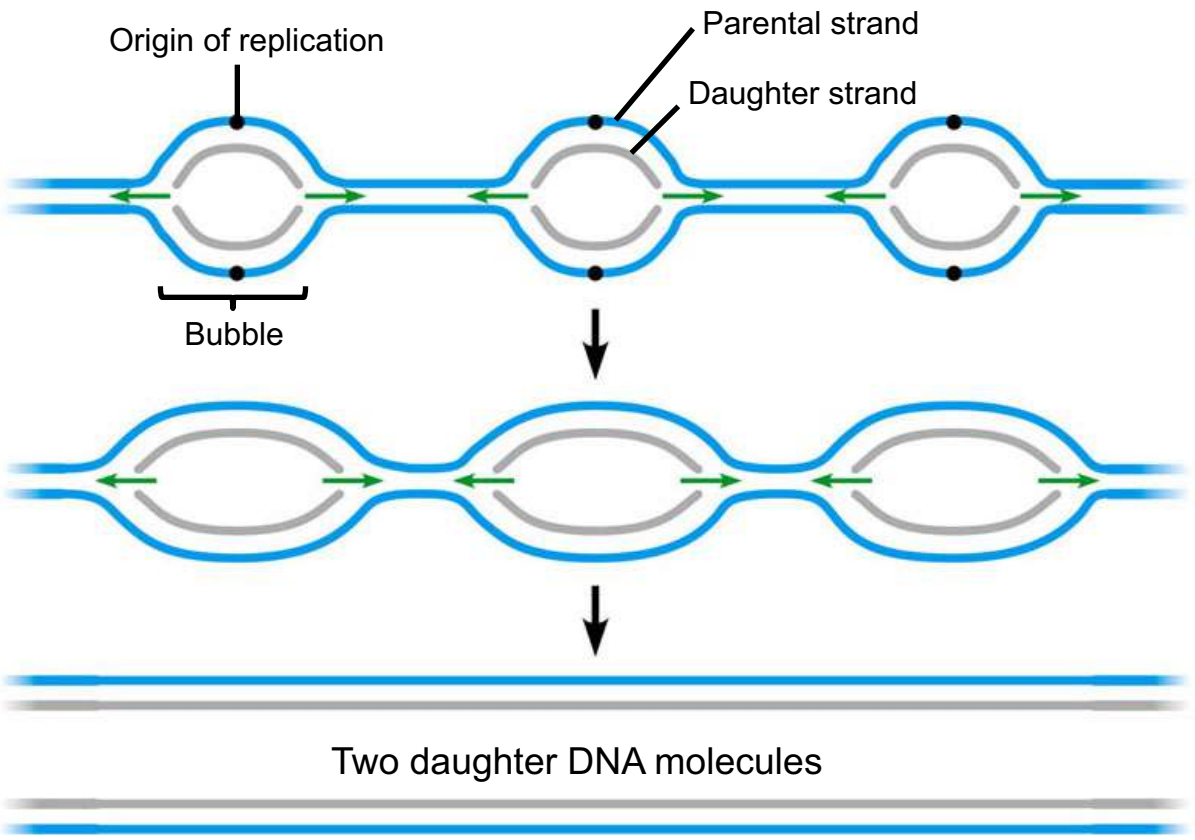
DNA Replication

- DNA replication is a complex process
  - Due in part to the fact that some of the helical DNA molecule must untwist



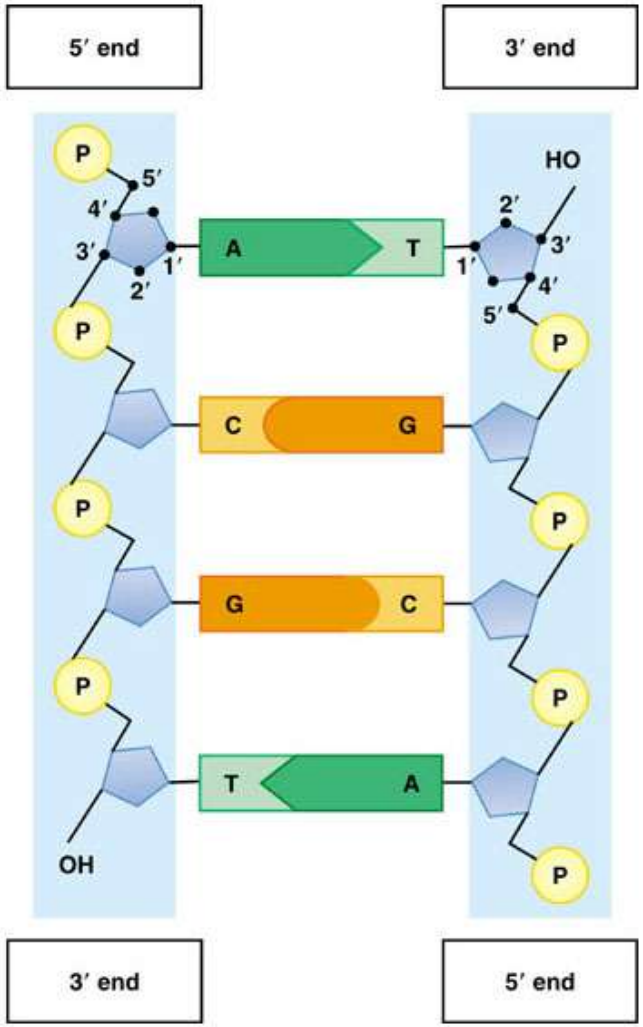
DNA Replication

- DNA replication
  - Begins at specific sites on the double helix



DNA Replication

- Each strand of the double helix
  - Is oriented in the opposite direction (antiparallel)



DNA Replication

- Using the enzyme DNA polymerase
  - The cell synthesizes one daughter strand as a continuous piece
- The other strand is synthesized as a series of short pieces
  - Which are then connected by the enzyme DNA ligase

DNA Replication