

Unit 5- Concept 1

# THE DNA DISCOVERY

# Inheritance has always puzzled people

- No one really knew how it worked
  - Mendel wasn't known till the late 1800's
    - He didn't even know what chromosomes were!
  - DNA was discovered in 1869
    - No one was sure what it did

## By the early 1900's ...

- This is all we knew about inheritance
  - Traits are passed from parent to offspring
  - Heredity of traits can be predicted
    - From Mendel
  - Genes are found on chromosomes
    - From Morgan
- But we still did not know what the molecule of heredity was



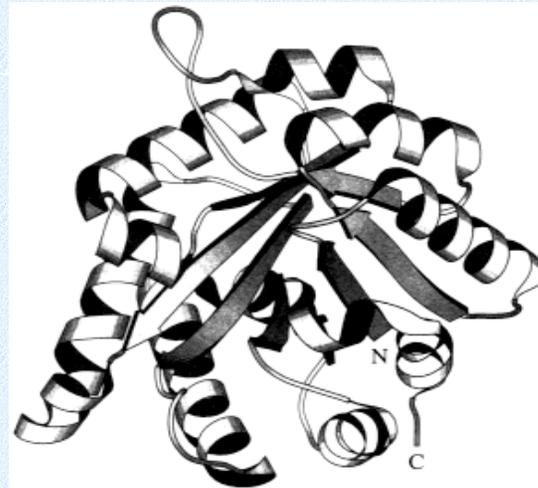
# Chromosomes

- Scientists had discovered that the chromosomes were made of 2 materials
  - DNA
  - Protein
- One of them had to be the genetic material

# The case for proteins

- Most scientists thought that protein was the genetic material because it was complex

- Lots of shapes



- No one really knew much about DNA
  - Components of nucleotides had been discovered



# Important Scientist People

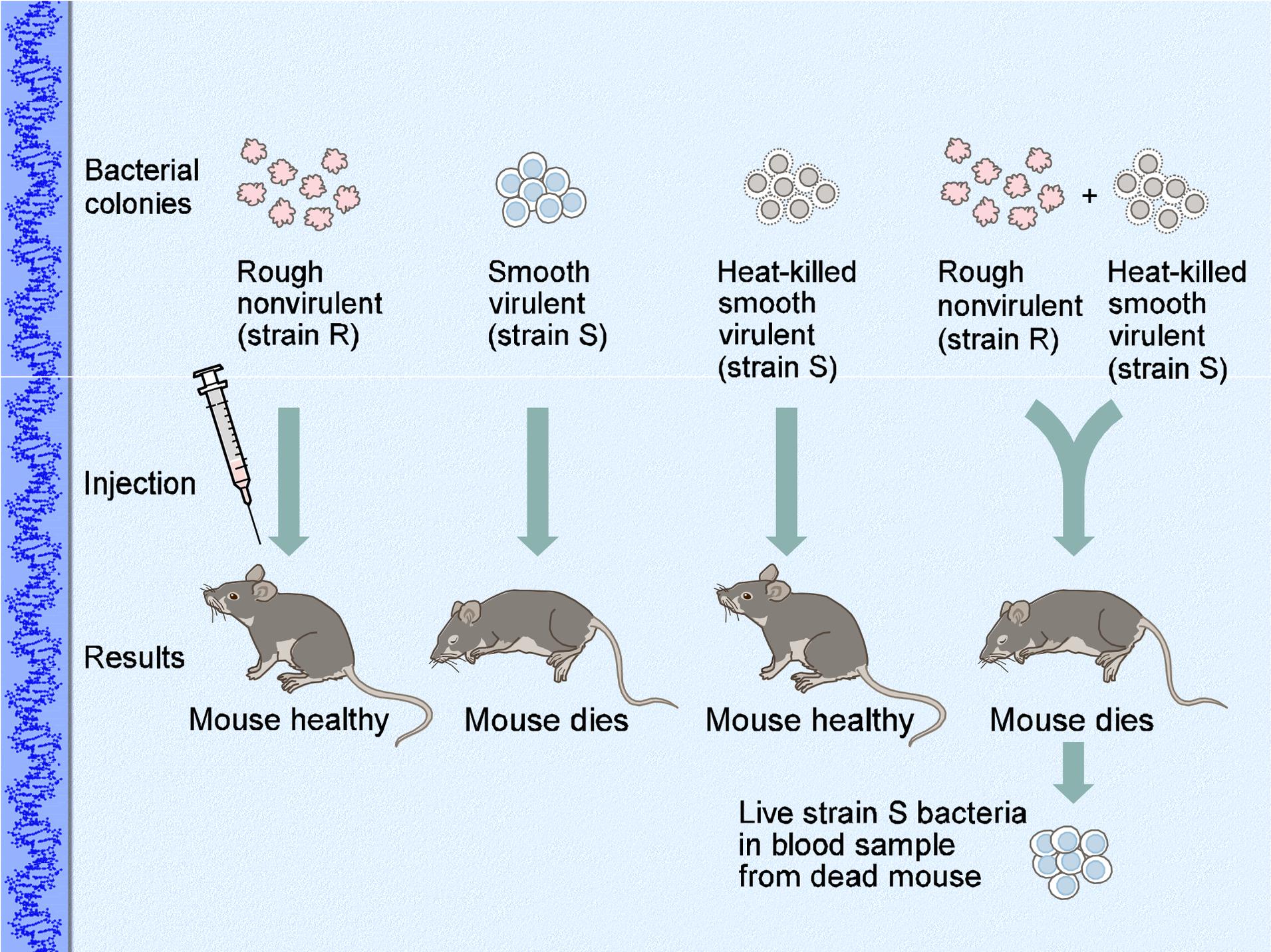
- Each one of these scientists helped provide evidence to confirm that DNA was the genetic material
  - Griffith
  - Avery/McCarty/MacLeod
  - Hershey/Chase
  - Franklin/Wilkins
  - Watson/Crick

# Important Scientist People

- What did they do that was important with the study of DNA?
- Pretend to be a scientist
  - What were you researching?
  - What did you find?
  - How did your research contribute to the overall discovery of DNA as the genetic material?

# Experiments shed new light

- 1928: Fredrick Griffith
  - Studying the effects of *Streptococcus pneumoniae*
  - Two strains:
    - Smooth- pathogenic
    - Rough - harmless



# Transformation

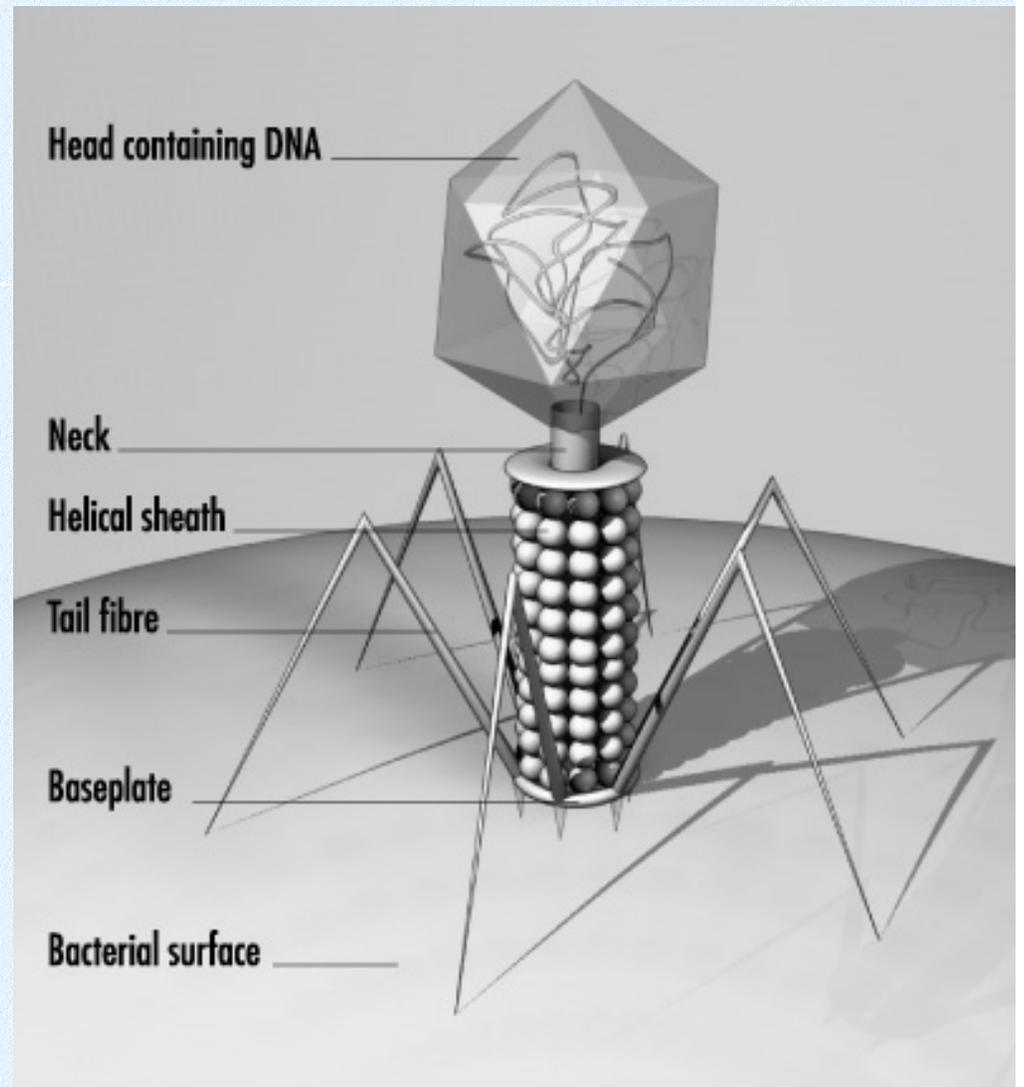
- Demonstrated that “something” passed from one bacteria to the other, changing the bacteria’s properties
- Transformation: the change in genotype and phenotype due to the incorporation of new DNA

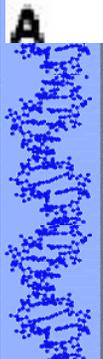
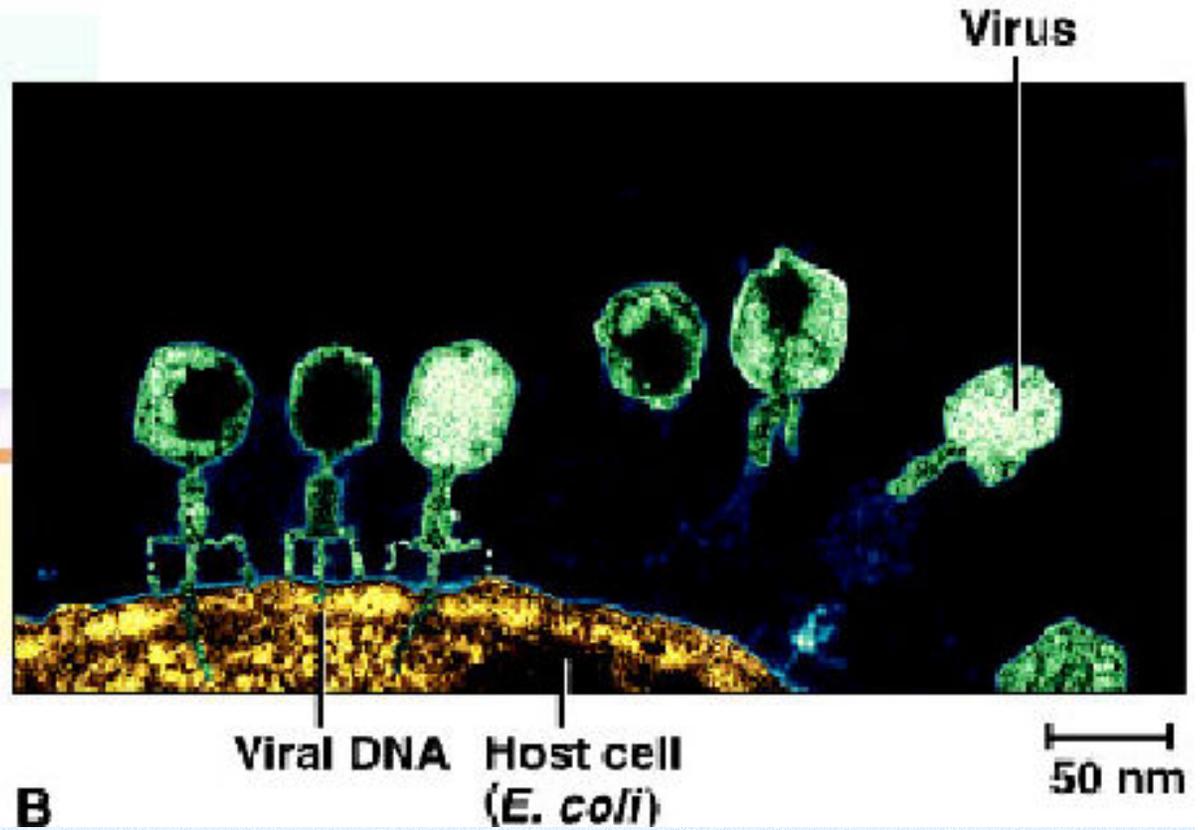
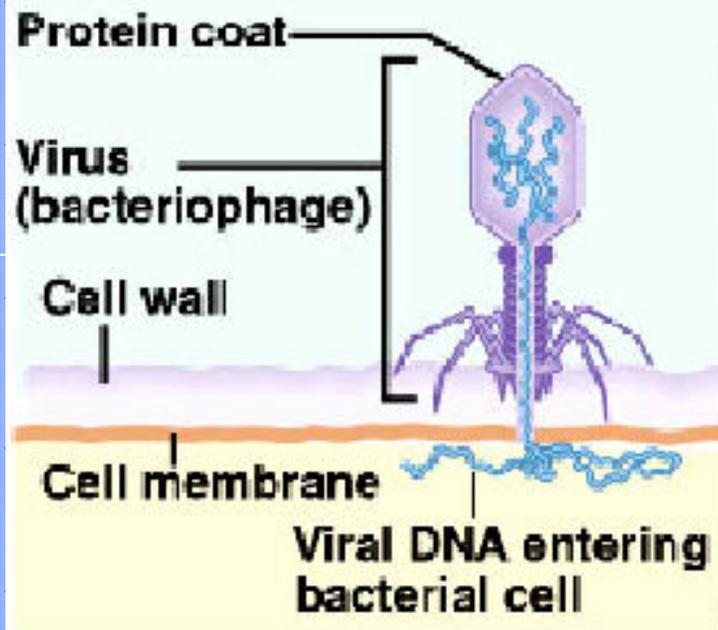
# Follow-up experiments

- Oswald Avery, Maclyn McCarty and Colin MacLeod: 14 years of experiments ending in 1944
  - Avery originally wanted to disprove transformation but then wanted to know what caused it
  - Purified substances from Griffith's experiment
  - Demonstrated that DNA was capable of transforming bacteria
  - Results received with skepticism

# Further evidence

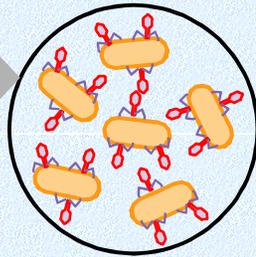
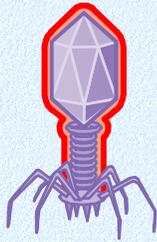
- 1952: Alfred Hershey and Martha Chase
  - Used bacteriophages to determine whether the genetic material is DNA or protein





# Hershey-Chase Experiment

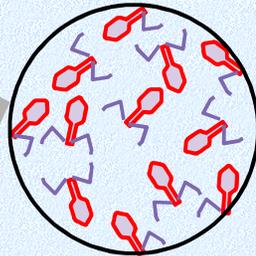
Viral protein coat radioactively labeled (sulfur)



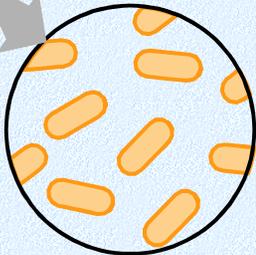
Viruses infect bacteria



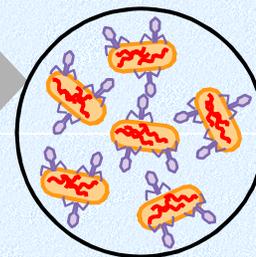
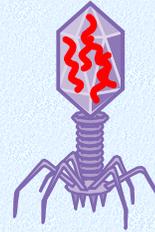
Viral protein coats (radioactive)



Bacteria with viral DNA (nonradioactive)



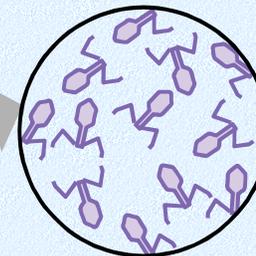
Viral DNA radioactively labeled (phosphorus)



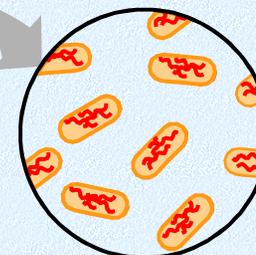
Blended and centrifuged to separate cells from virus



Viral protein coats (nonradioactive)



Bacteria with viral DNA (radioactive)



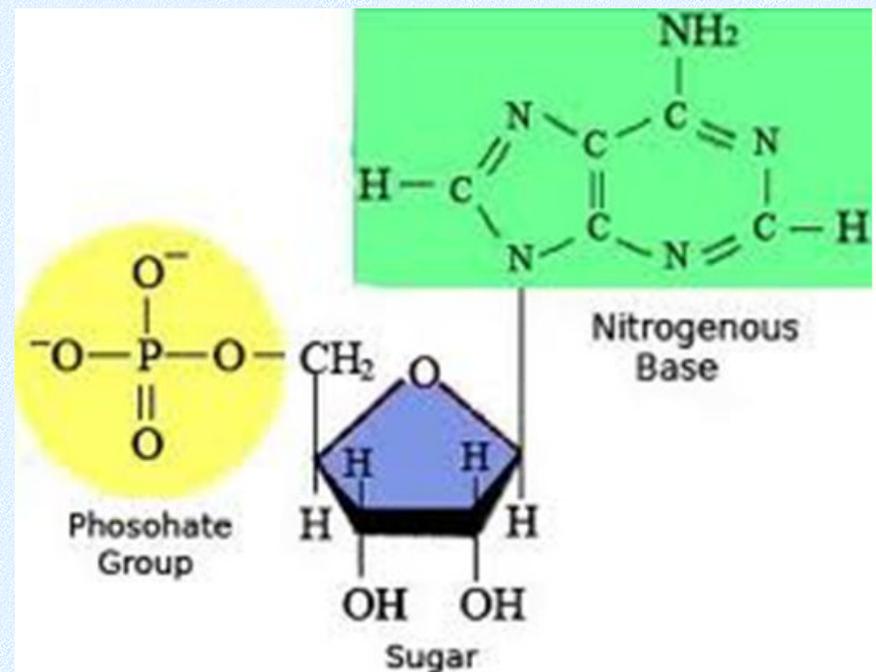


# Results

- DNA is the genetic material
- Was there any additional evidence that DNA could have been the genetic material?

# Yep. More evidence

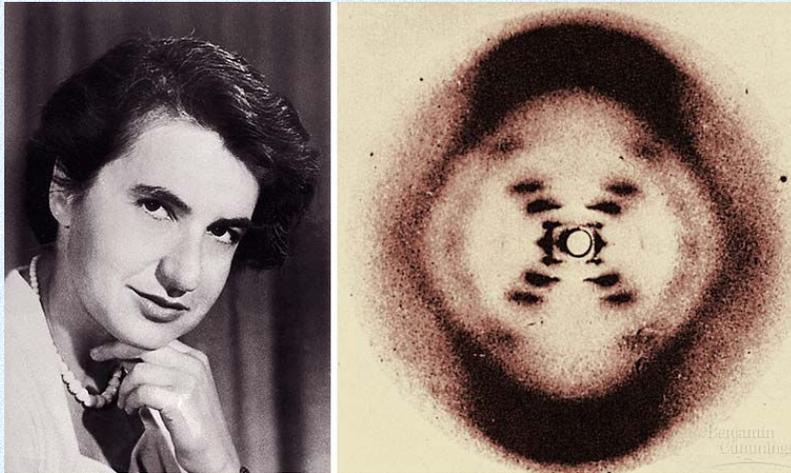
- Scientists already knew that DNA was a polymer of nucleotides
  - Sugar, phosphate, base
- 1947: Edwin Chargaff
  - Discovered that the base composition of DNA varies across species
  - Ratio of DNA bases
    - A = 30.3 %
    - T = 30.3%
    - C = 19.5%
    - G = 19.9%



# Ok, we get it already!

- Once accepted as the hereditary molecule, scientists worked to determine the exact structure of DNA
- Competing groups of scientists
  - Linus Pauling
  - Maurice Wilkins and Rosalind Franklin
  - James Watson and Francis Crick

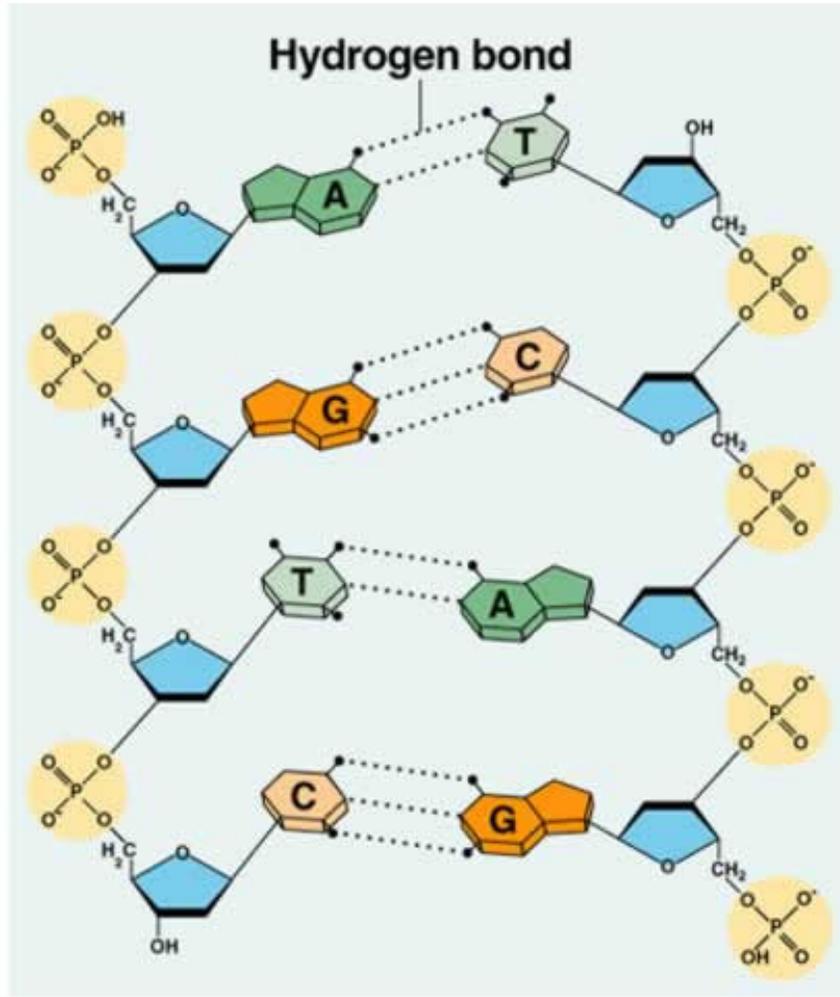
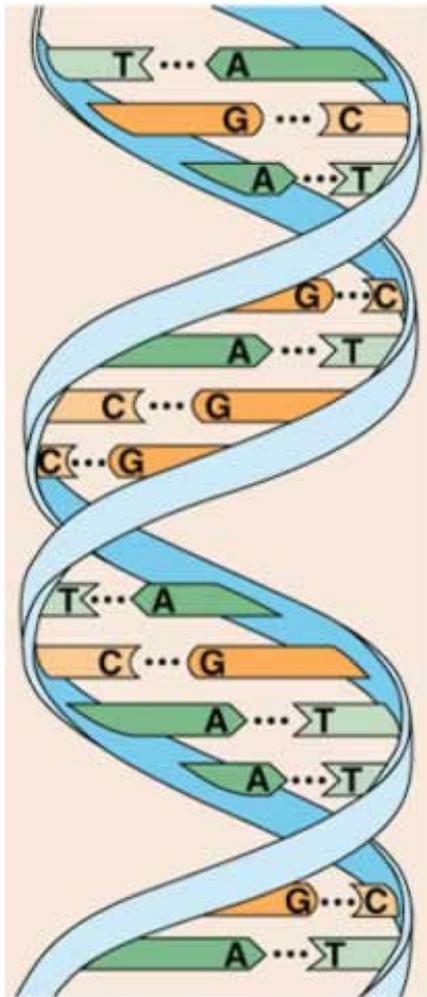
- Maurice Wilkins and Rosalind Franklin used X-ray crystallography to study the structure of DNA

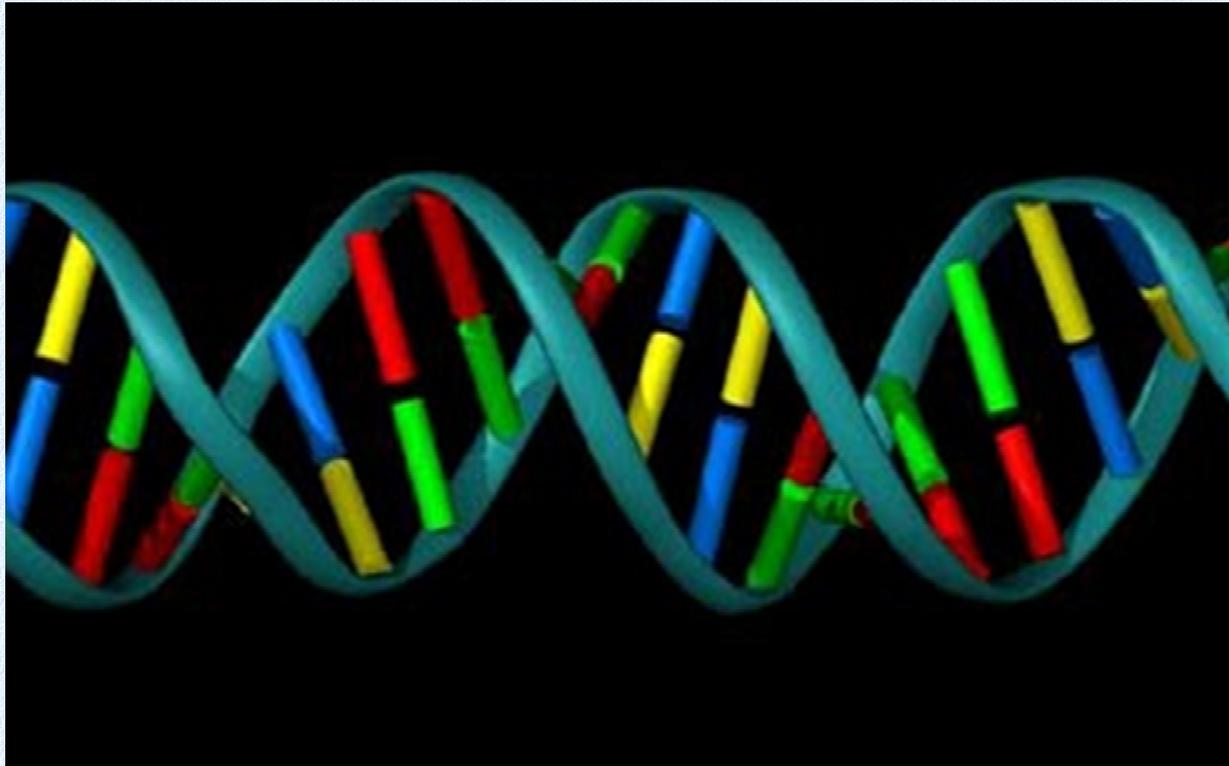


- 1953: Watson and Crick used this information to deduce the double helical structure of DNA



# DNA structure- The Double Helix





Unit 5- Concept 2

# **DNA STRUCTURE**

# The Big Idea...

- Living systems store, retrieve, transmit and respond to information essential to life processes.



# How do living things manage information?

- Storage?
  - Retrieval?
  - Transmission?
  - Response?
- 
- **DNA!!!**
    - With some help from RNA



How does DNA or RNA  
actually do all of this  
information carrying/storing  
stuff?



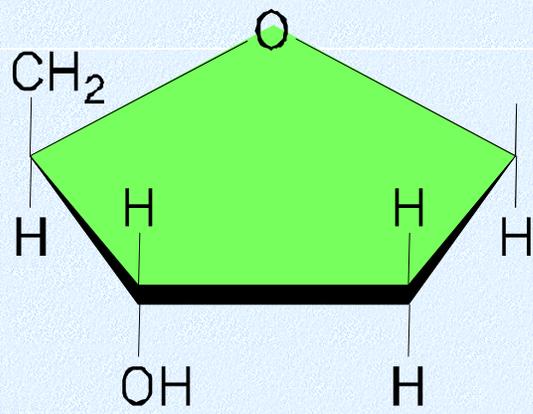
# How does DNA or RNA do this?

- It carries a code.
- The structure of DNA is made of a series of chemical molecules used in a sequence.
- The specific sequence of the molecules produces a code.
  - That's the A T C G stuff

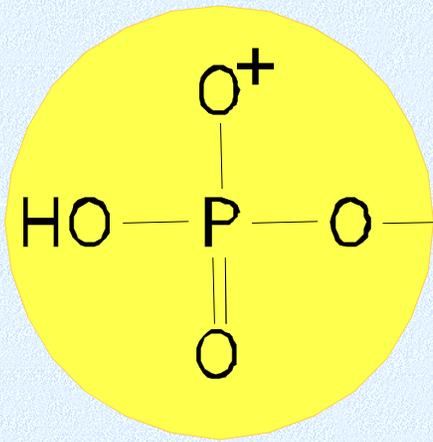


# Mini review

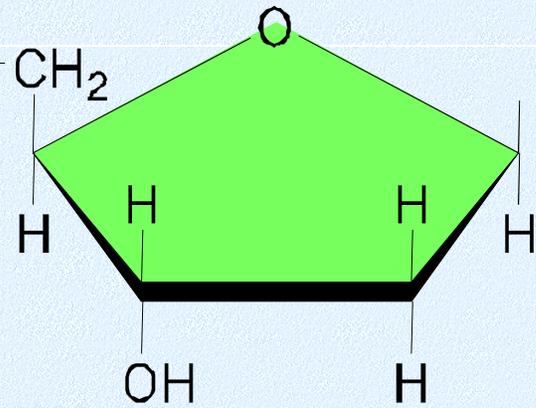
- DNA Structure
  - Nucleotide
  - Purines and Pyrimidines
  - Base pairing rules
  - Antiparallel double helix
  - DNA is the heritable material
- RNA Structure
  - Uracil
  - Single strand



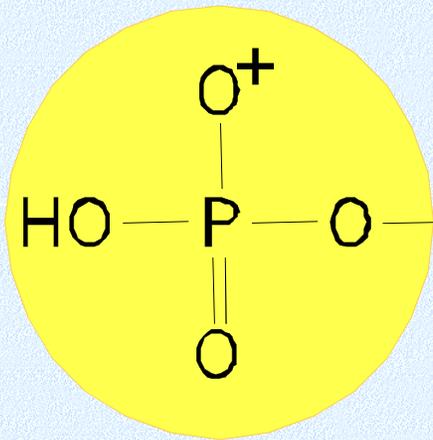
Sugar (Deoxyribose)



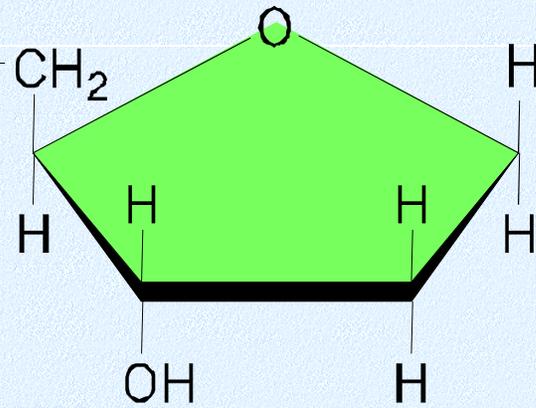
Phosphate  
group



Sugar (Deoxyribose)

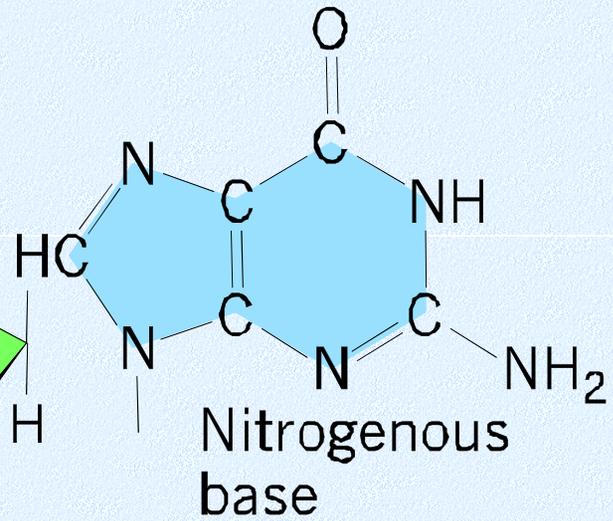


Phosphate group



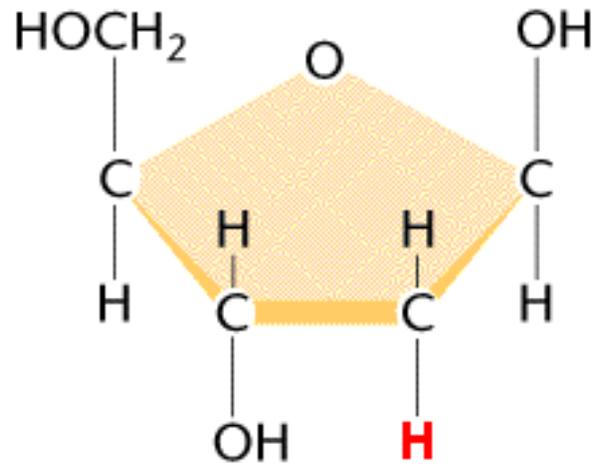
Sugar (Deoxyribose)

## Guanine (G)

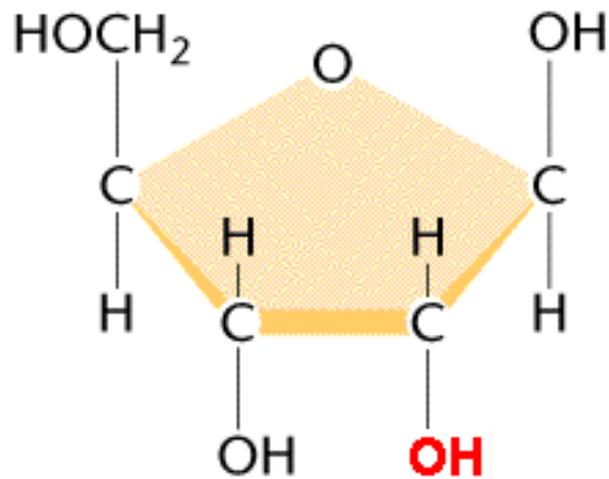


Nitrogenous base

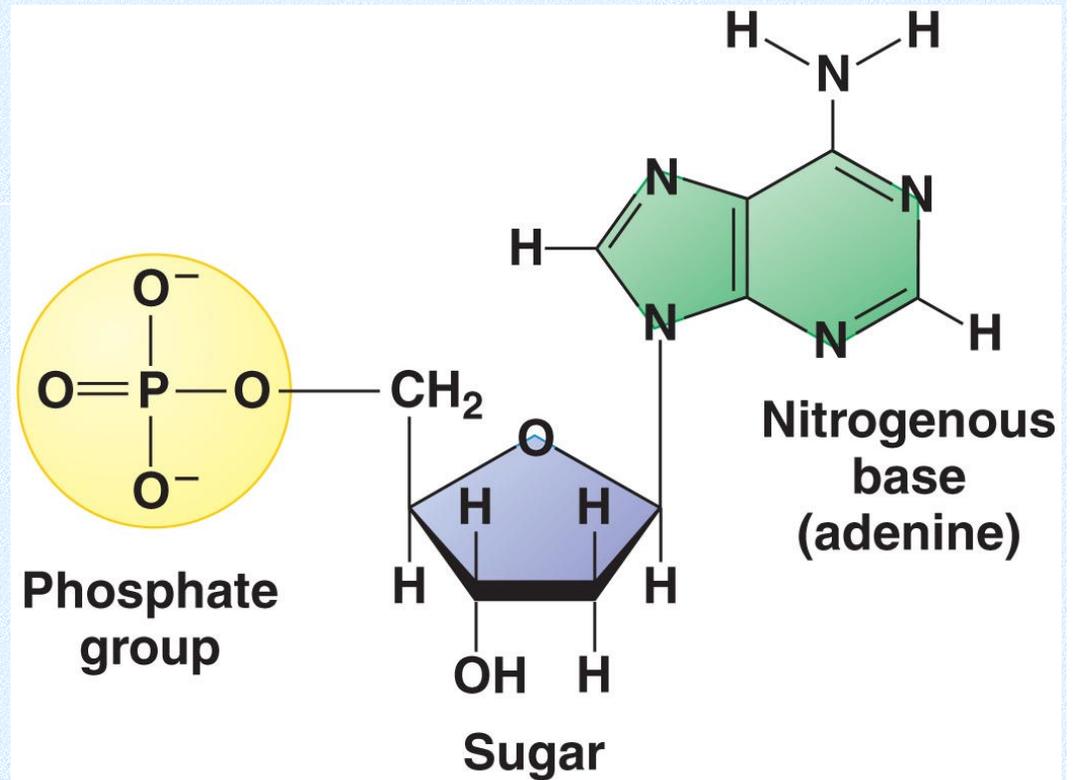
# Nucleotide structure



2-Deoxyribose



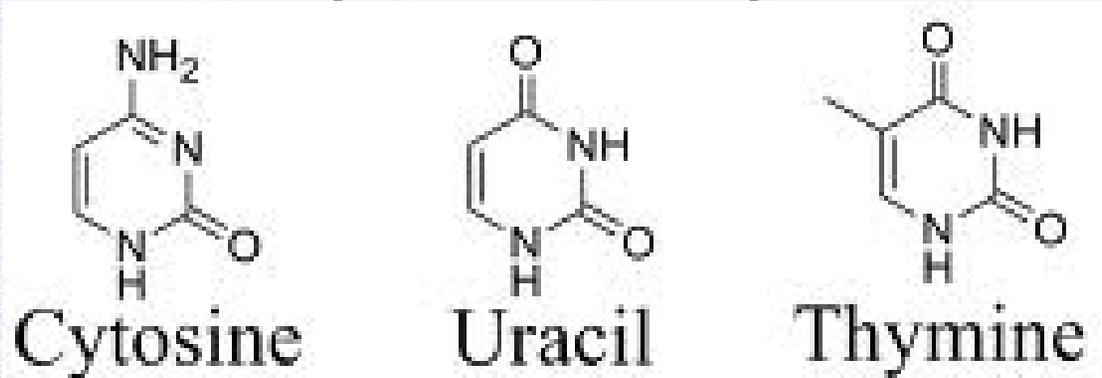
Ribose



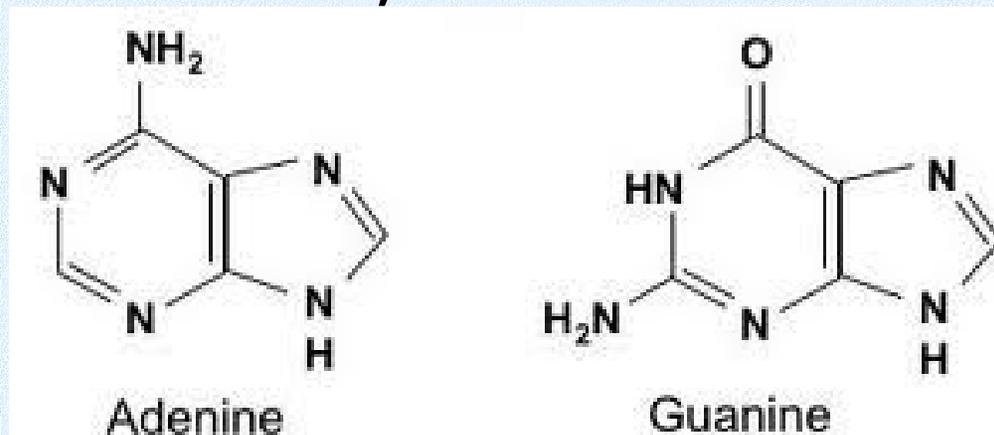
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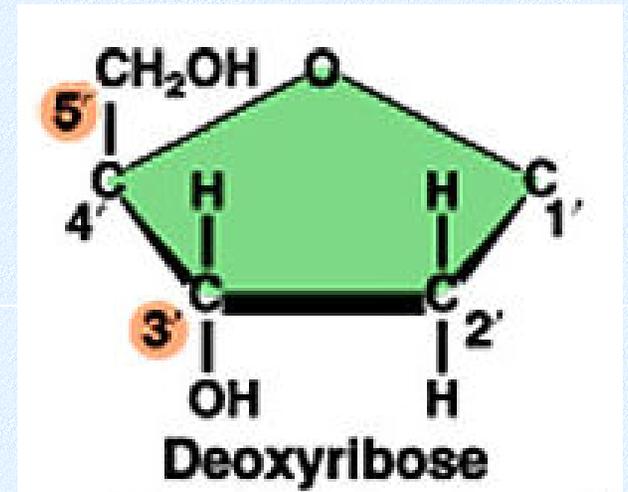
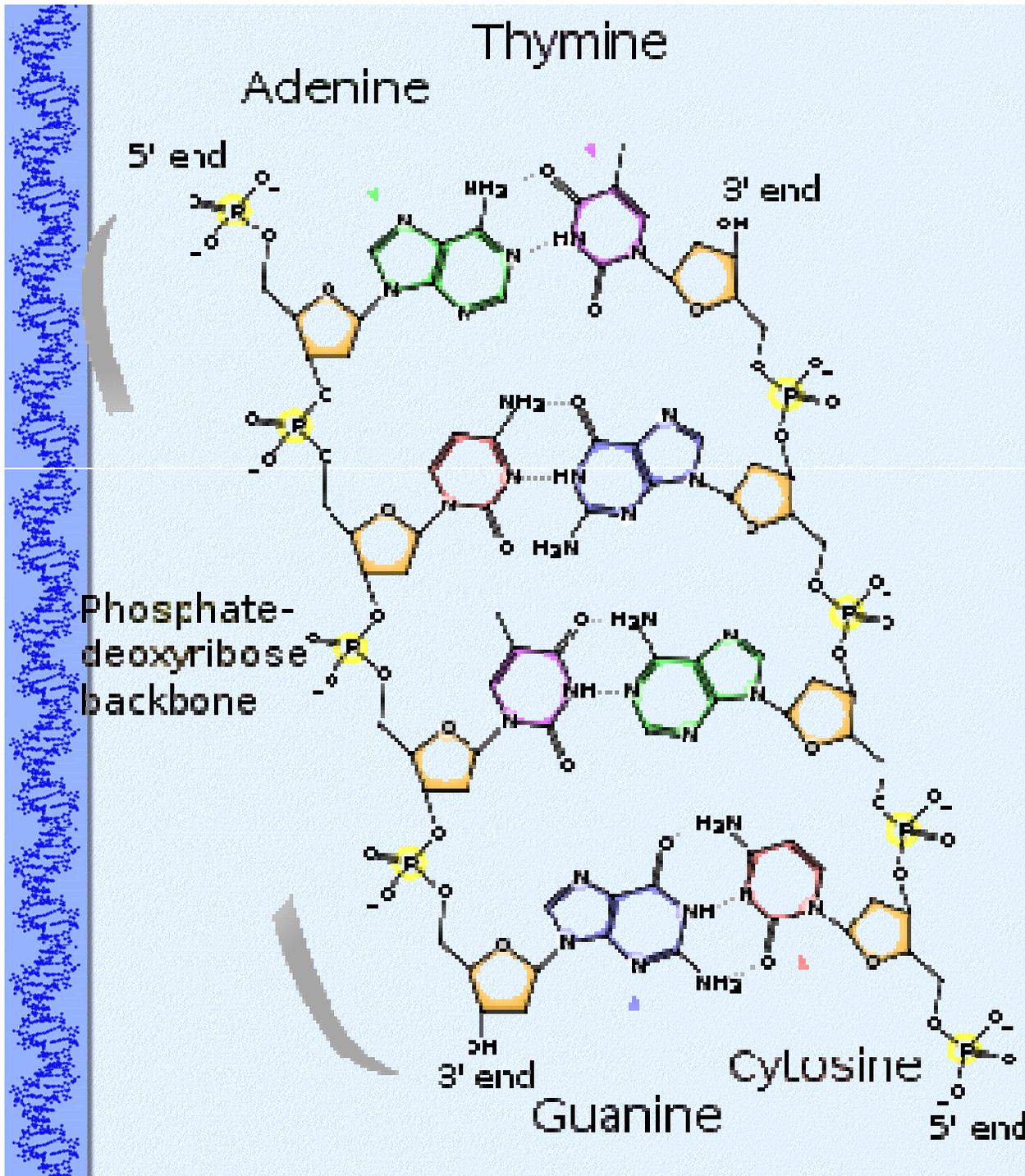
# Two classifications of monomers

- Pyrimidines: Cytosine, Thymine, Uracil



- Purines: Adenine, Guanine





Numbering of strands is based on position of deoxyribose sugars



- Let's make a model