

An Overview of How DNA Was Discovered

By Nina Theriot

“There are as many atoms in one molecule of DNA as there are stars
in a typical galaxy.”

-Carl Sagan

Milestones in Discovering DNA

1869

Friedrich Miescher -
discovery of
“nuclein”

1885-1901

Albrecht Kossel -
discovered
nucleoproteins
and nucleobases

1940s

Erwin Chargaff -
discovered 1:1 ratio
for adenine:thymine
and cytosine:guanine

1953/1954

Watson and Crick -
model of DNA
double helix

1857

Gregor Mendel -
pea plants

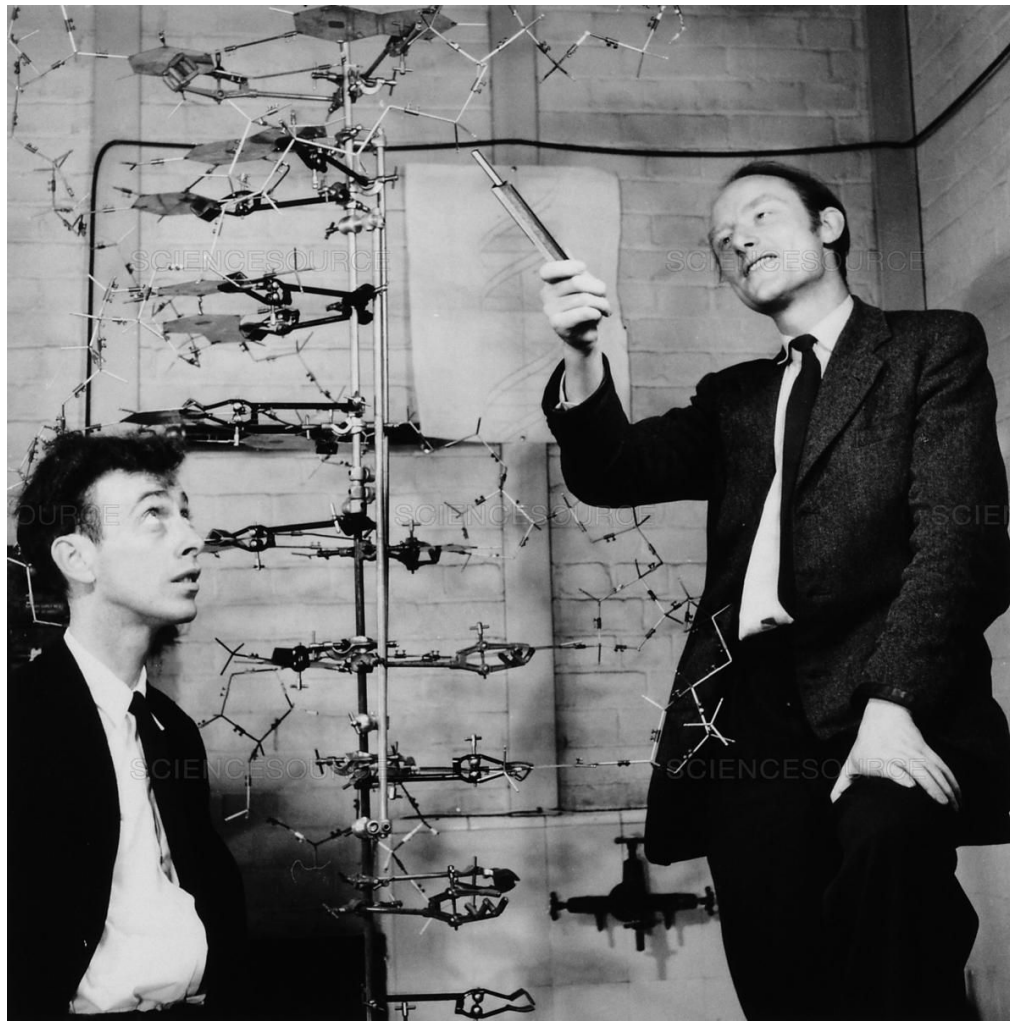
1929

Phoebus Levene -
identified
components of
DNA

1952

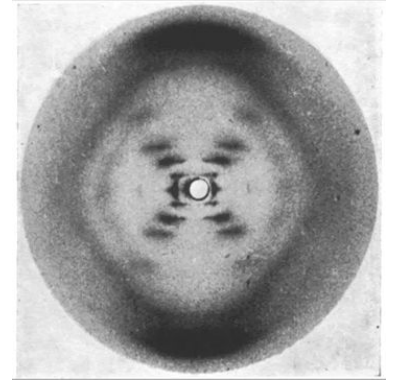
Rosalind Franklin - X-ray
crystallography of DNA,
visible structure

Does anybody recognize the names Watson and Crick?



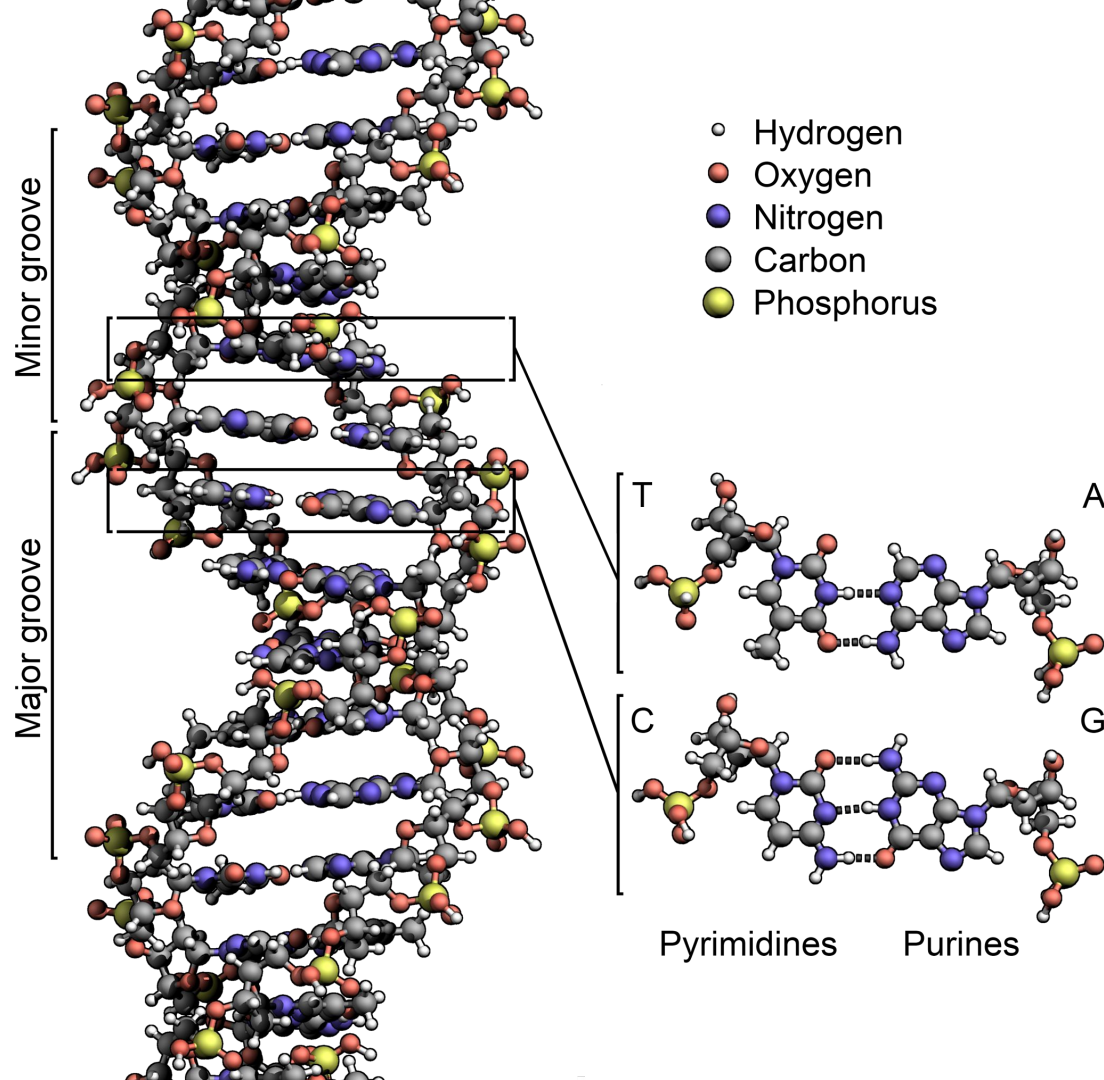
How did they figure out the structure of DNA?

Experimental results from other researchers



Knowledge of Chemistry

- Knew of Components
- Hydrogen bonds
- Stability
- Negative charges repel

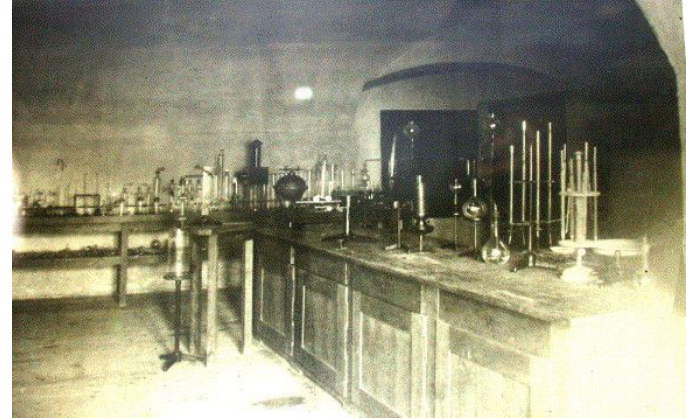
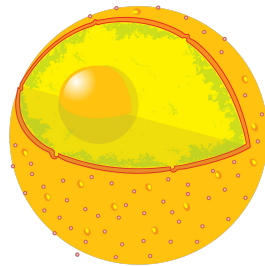


(Brennan, 2017)

What experiments did they draw their conclusion from?

Friedrich Miescher - 1869

- Obtained white blood cells from surgical bandages
- Solution of white blood cells
 - Added acid to solution → precipitate formed
 - Added base to solution → precipitate dissolved
- Cytoplasm → mostly proteins and lipids
- Miescher concluded → originated in the nucleus
- Decided to study nuclei



Miescher's First Protocol

1. Diluted sodium sulfate → isolates white blood cells
2. Diluted HCl → isolates some nuclei
3. Water and ether → purifies nuclei
4. Diluted sodium carbonate → “yellow solution”
5. Excess acid → “insoluble, flocculent precipitate”
 - Re-dissolves after adding alkaline solutions

Miescher's Second Protocol

1. White blood cells washed with “warm alcohol” → removes lipids
2. Pepsin digests proteins → pure nuclei obtained
3. Ether → removes lipids
4. Wash with water
5. Diluted sodium carbonate → “yellow solution of a substance”
6. Excess acid → “insoluble, flocculent precipitate”

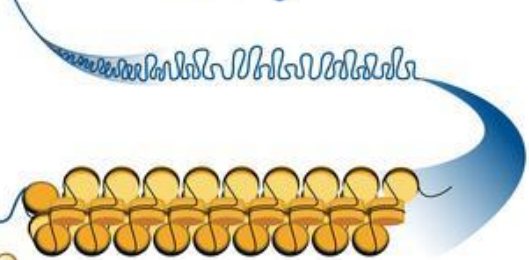
Friedrich Miescher - 1869

- Not a protein
 - Not digested by pepsin
 - Dissolves in “low alkaline” solutions
 - Precipitates in acidic solutions
 - Contains phosphorus
- “Nuclein”
- Soluble in “low alkaline” solutions
- Precipitates in slightly acidic solutions



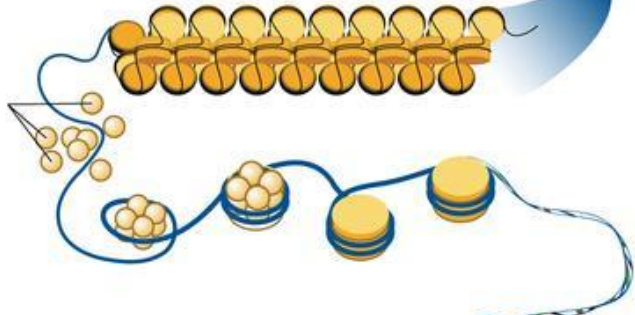


Chromosome



Chromatin fiber

Histones



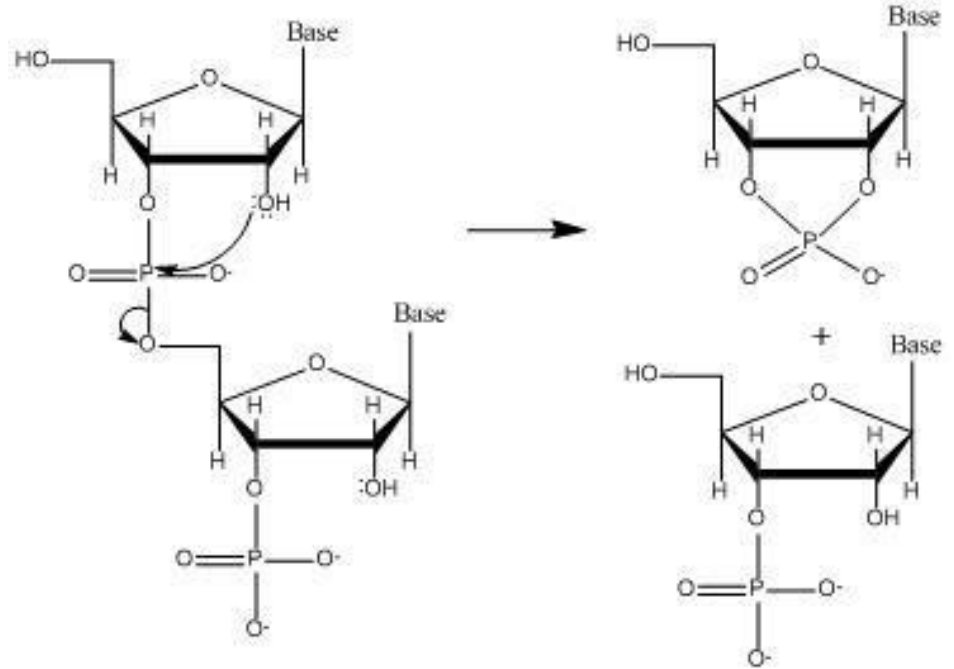
"Beads on a string"
DNA wound on nucleosomes



Double helix

Albrecht Kossel - 1885-1901

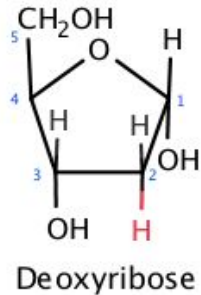
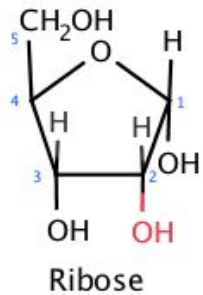
- Discovered components of nuclein
 - Protein portion
 - Non-protein portion (“nucleic acid”)
- Hydrolysis reaction
 - Used to discover nucleobases of DNA



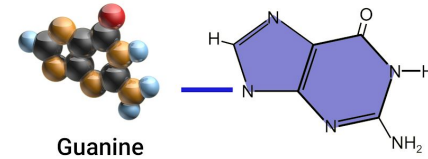
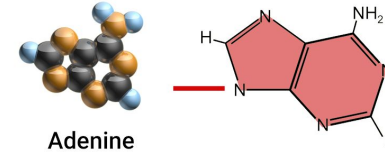
(“Albrecht Kossel”, n.d.)

Albrecht Kossel - 1885-1901

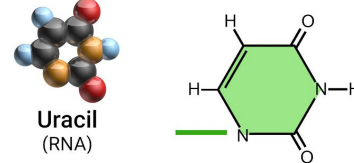
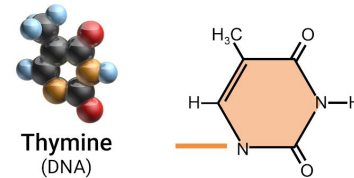
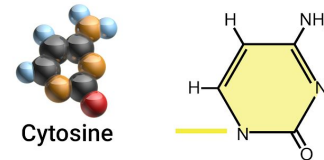
- Kossel discovered purine and pyrimidine bases
 - Guanine, adenine, thymine, uracil, cytosine
- Discovered a carbohydrate
 - Thought to be a pentose sugar



Purine

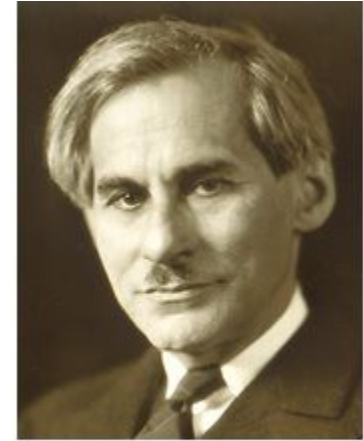


Pyrimidine



Phoebus Levene - 1929

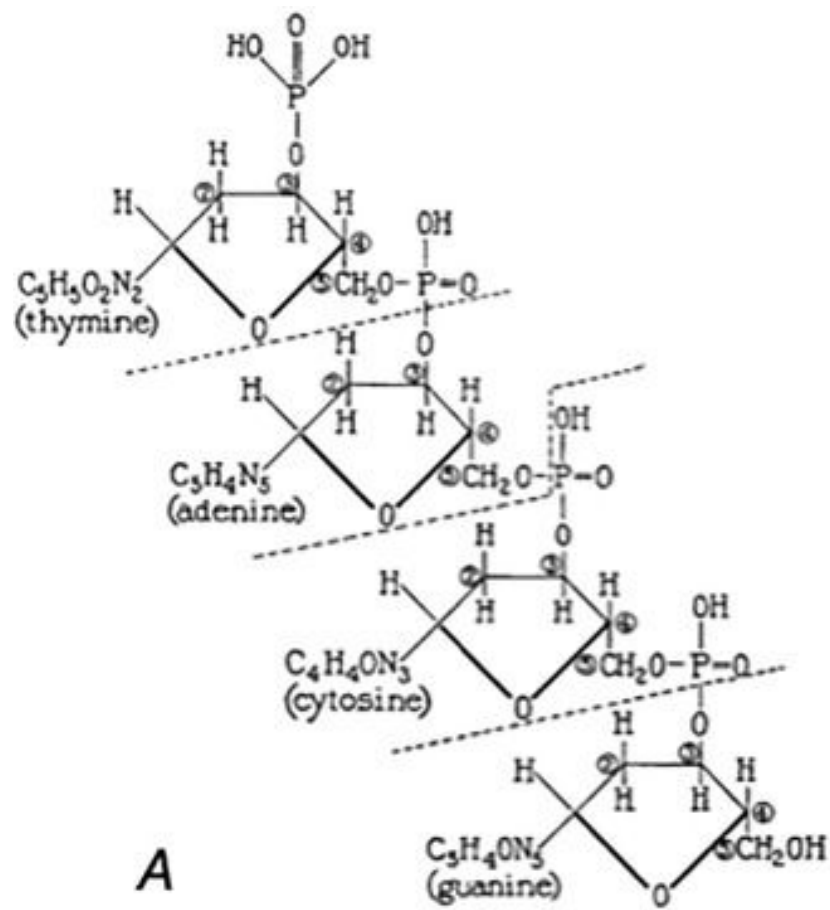
- Discovered the chemical formulas for DNA components
- Distinguished between DNA and RNA components



Phoebus Aaron Theodor Levene

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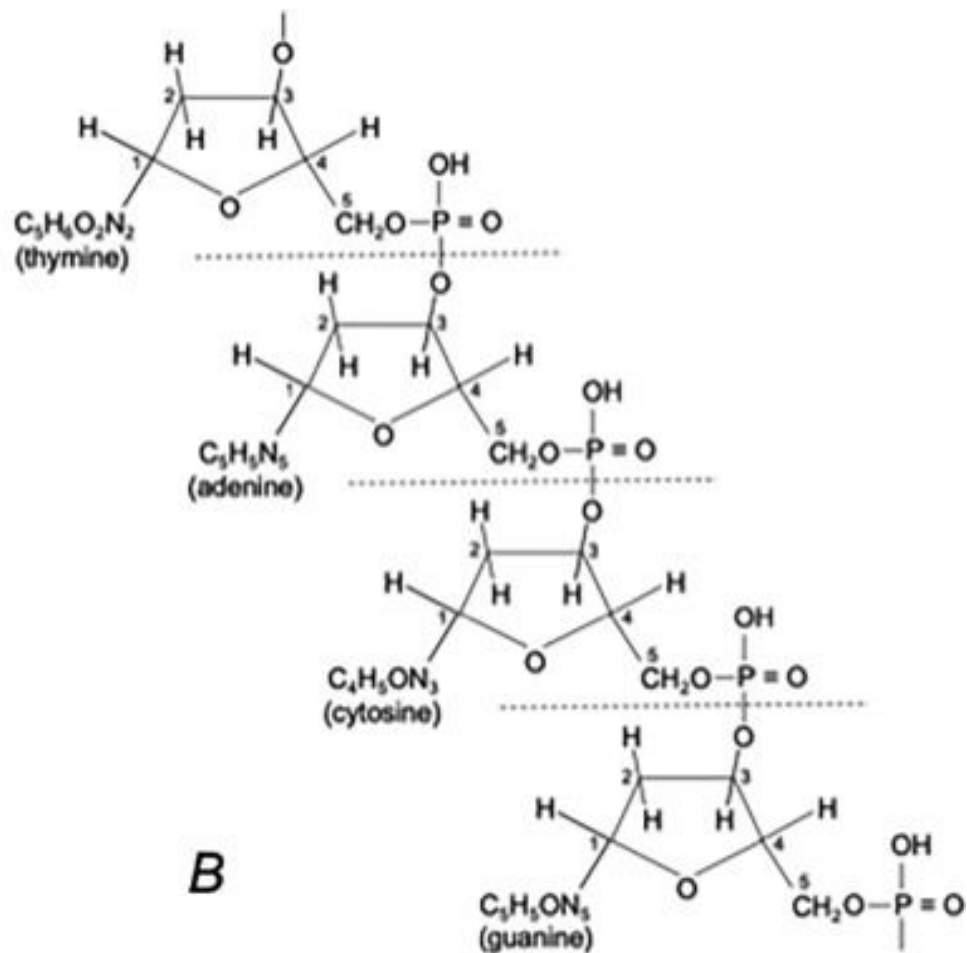
(“Phoebus Levene”, n.d.)



A

Desoxy-ribose nucleic acid ($C_{12}H_{18}O_{12}N_{11}P_4$)

I



B

Erwin Chargaff - 1940s

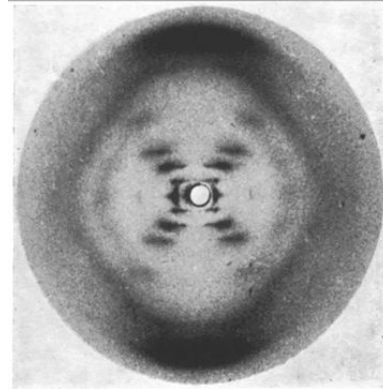
- Ratio of adenine:thymine is equal
- Ratio of cytosine:guanine is equal
- Suggests a method of replication
- “Complementary strand”



(Kresge et al., 2005)

Rosalind Franklin - 1952

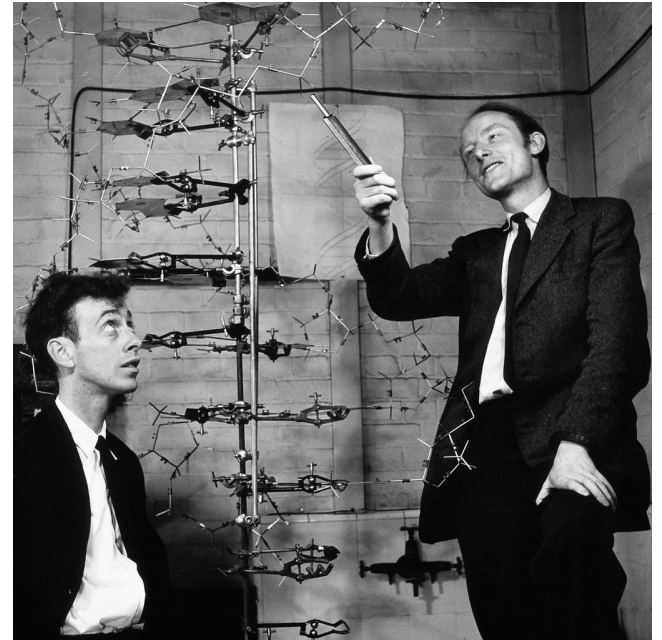
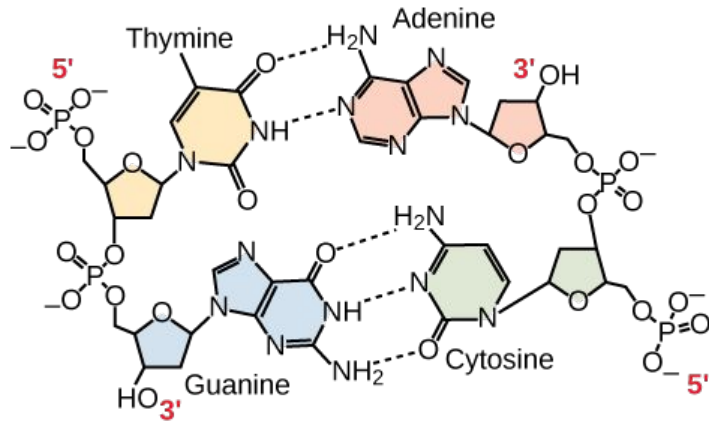
- X-ray crystallography

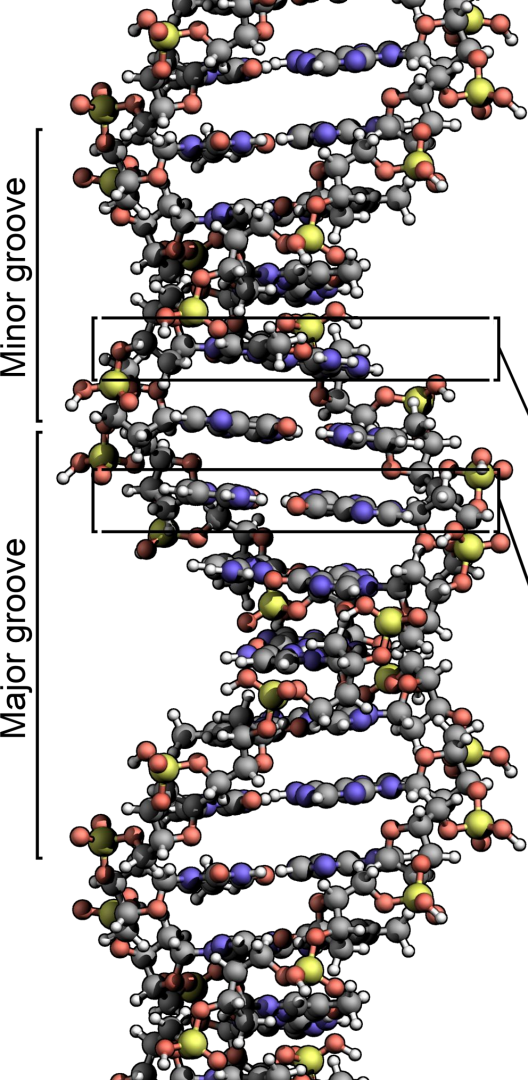


(Aliouche, n.d.)

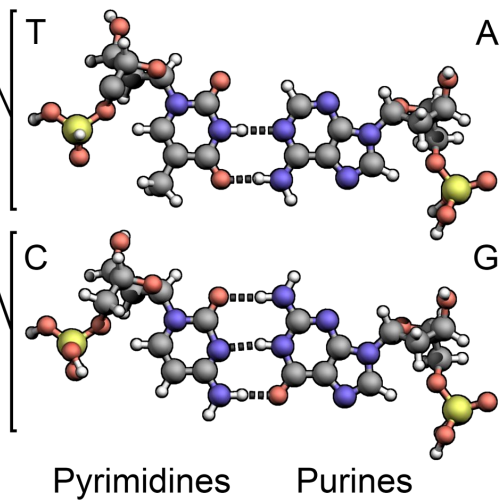
Watson and Crick - 1953/1954

- Chemical structure was known (for the most part)
- Jerry Donohue corrected the structure of thymine and guanine





- Hydrogen
- Oxygen
- Nitrogen
- Carbon
- Phosphorus





[How to extract DNA from strawberries](#)

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