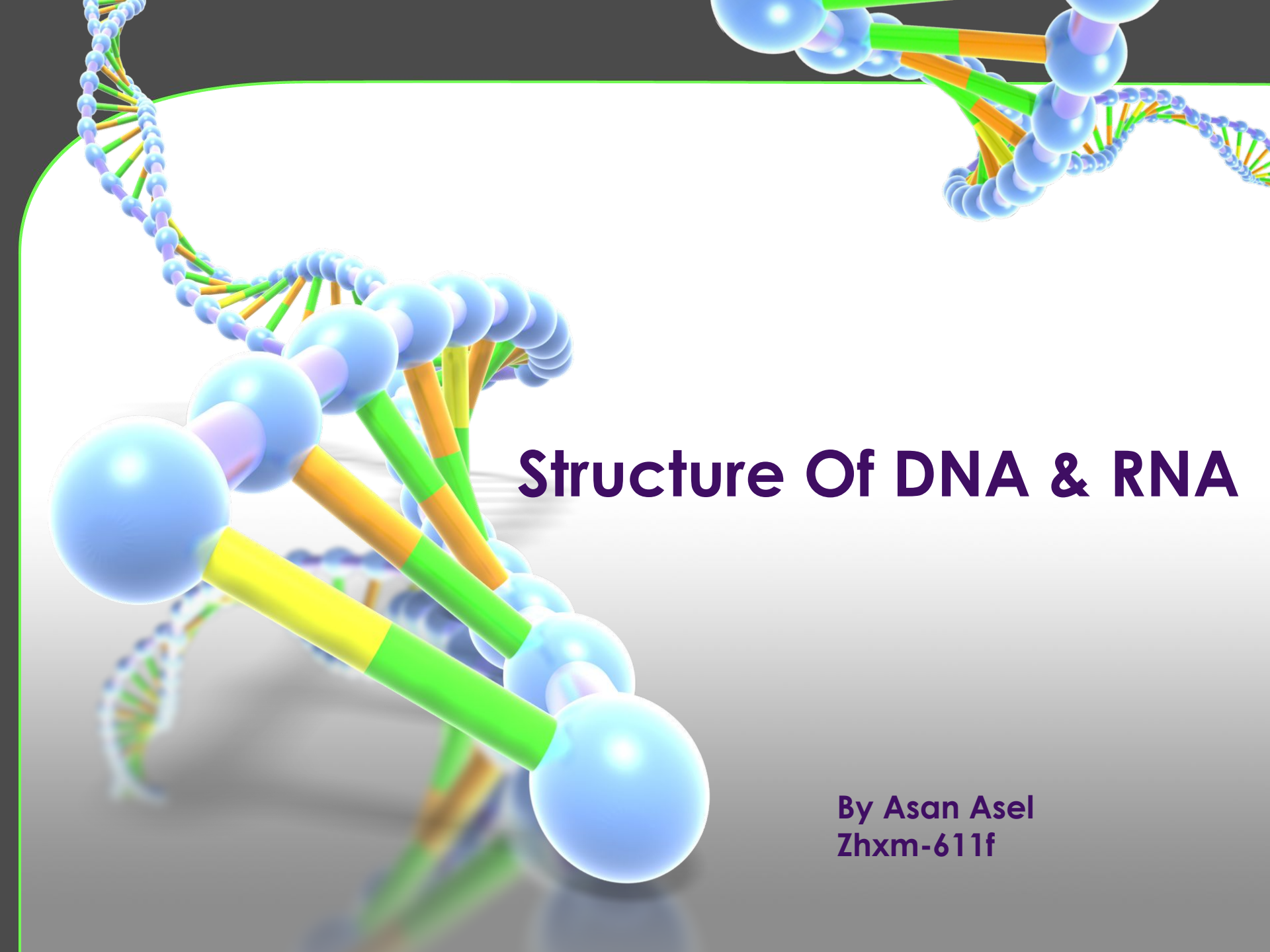




Structure Of DNA & RNA

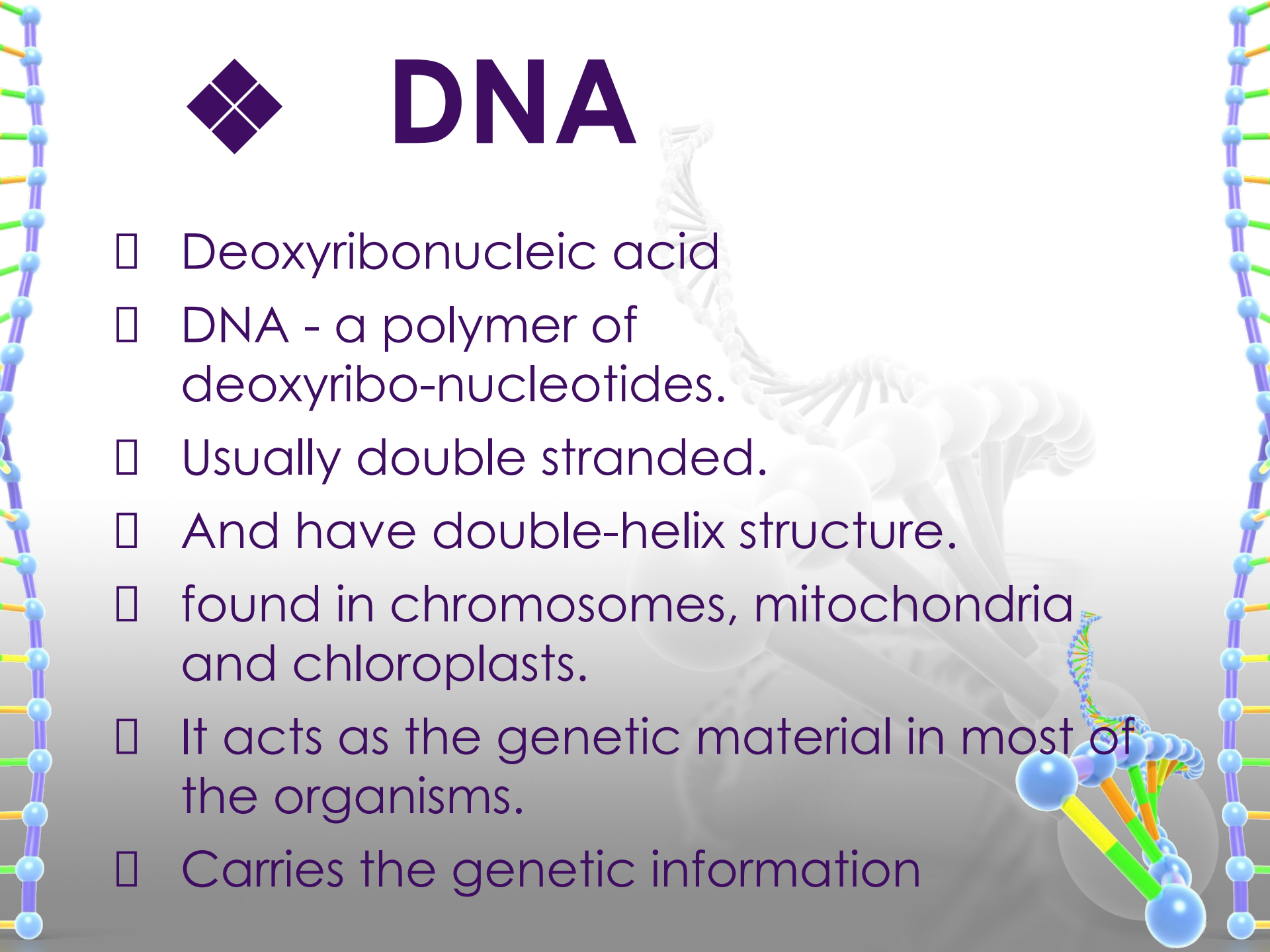
By Asan Asel
Zhxm-611f

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random][plasma]
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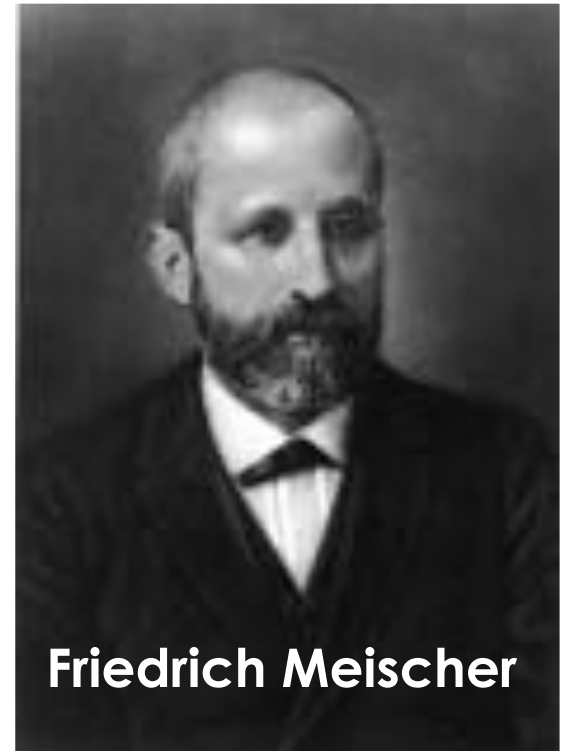
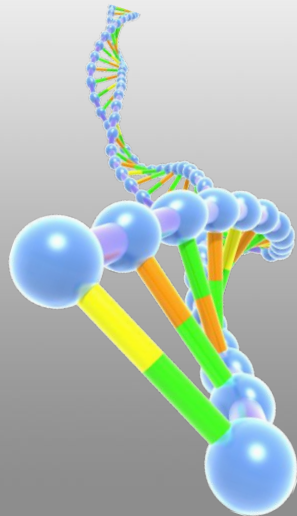
DNA

- Deoxyribonucleic acid
- DNA - a polymer of deoxyribo-nucleotides.
- Usually double stranded.
- And have double-helix structure.
- found in chromosomes, mitochondria and chloroplasts.
- It acts as the genetic material in most of the organisms.
- Carries the genetic information



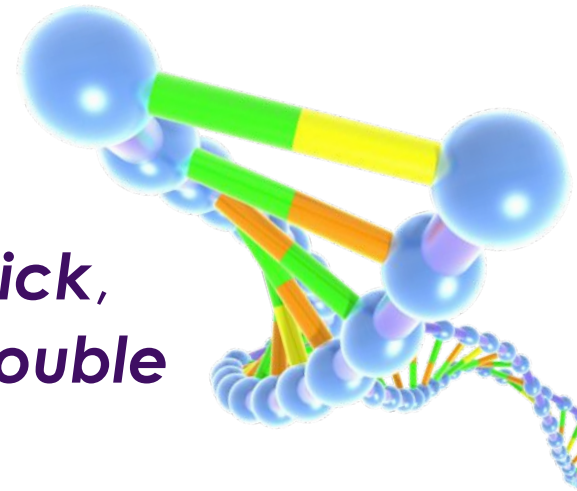
A Few Key Events Led to the Discovery of the Structure of DNA

- DNA as an acidic substance present in nucleus was first identified by ***Friedrich Meischer*** in 1868.
- He named it as 'Nuclein'.



Friedrich Meischer

□ In 1953 , **James Watson and Francis Crick**, described a very simple but famous **Double Helix** model for the structure of DNA.



FRANCIS CRICK AND JAMES WATSON



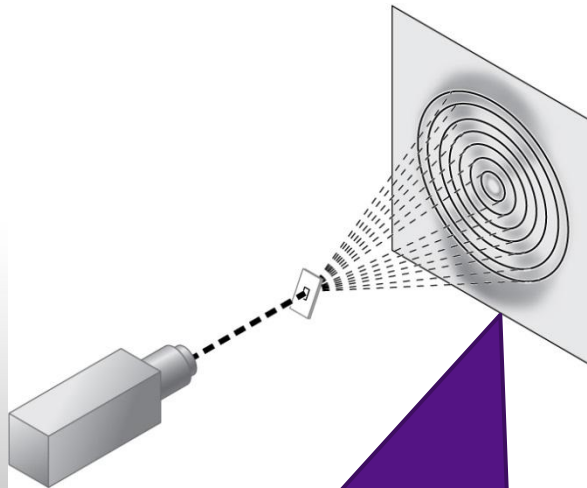
- The scientific framework for their breakthrough was provided by other scientists including
 - Linus Pauling
 - Rosalind Franklin and Maurice Wilkins
 - Erwin Chargaff



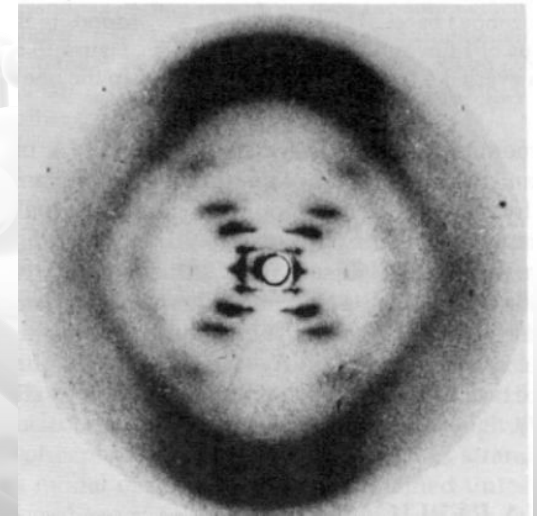
❖ Rosalind Franklin

- She worked in same laboratory as Maurice Wilkins.
- She study X-ray diffraction to study wet fibers of DNA.

X-ray diffraction
of wet DNA fibers

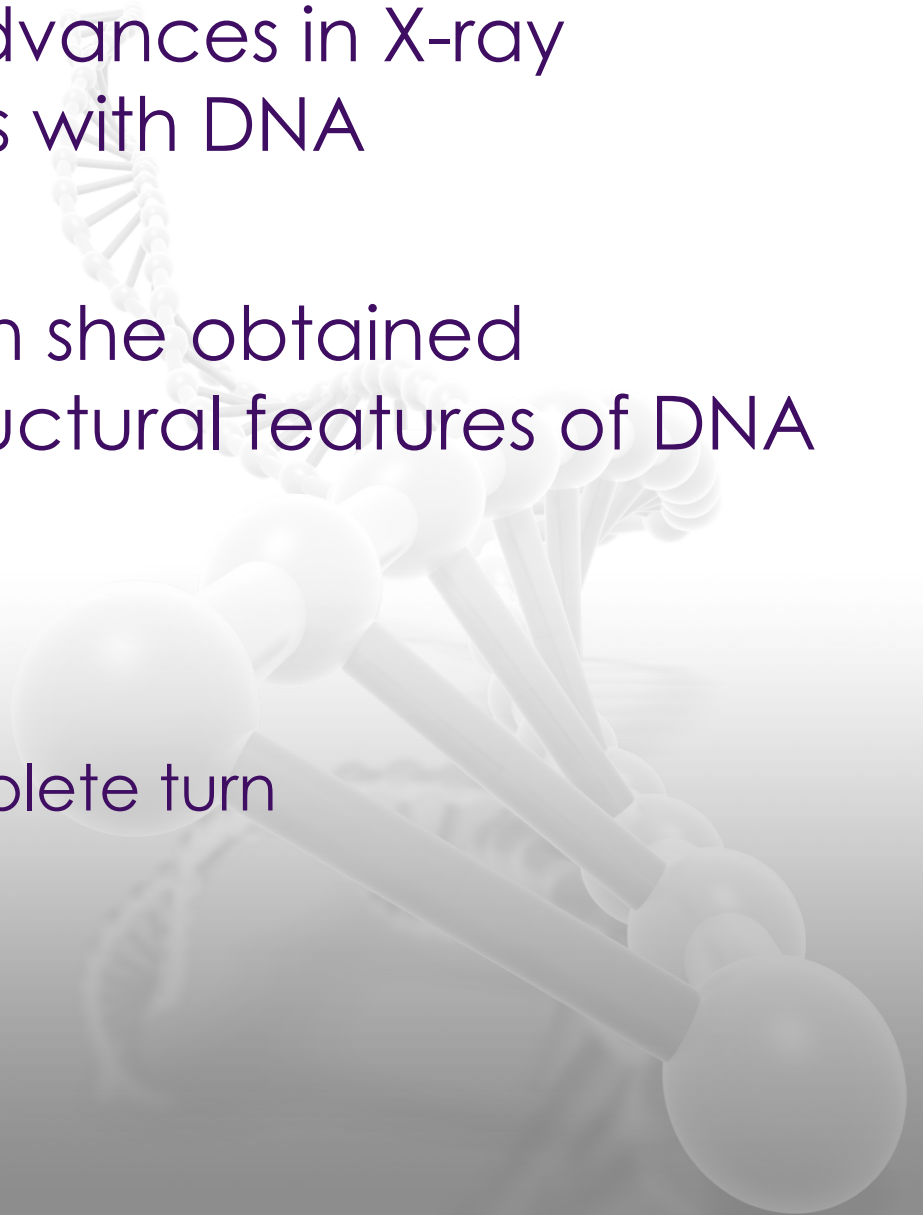


The diffraction pattern is interpreted
(using mathematical theory)
This can ultimately provide
information concerning the structure
of the molecule

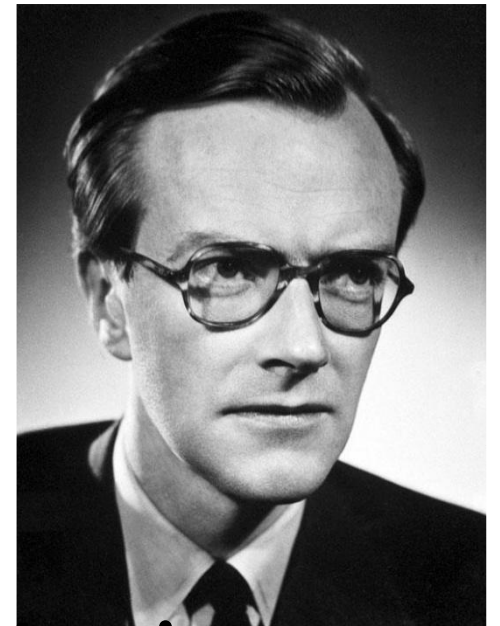
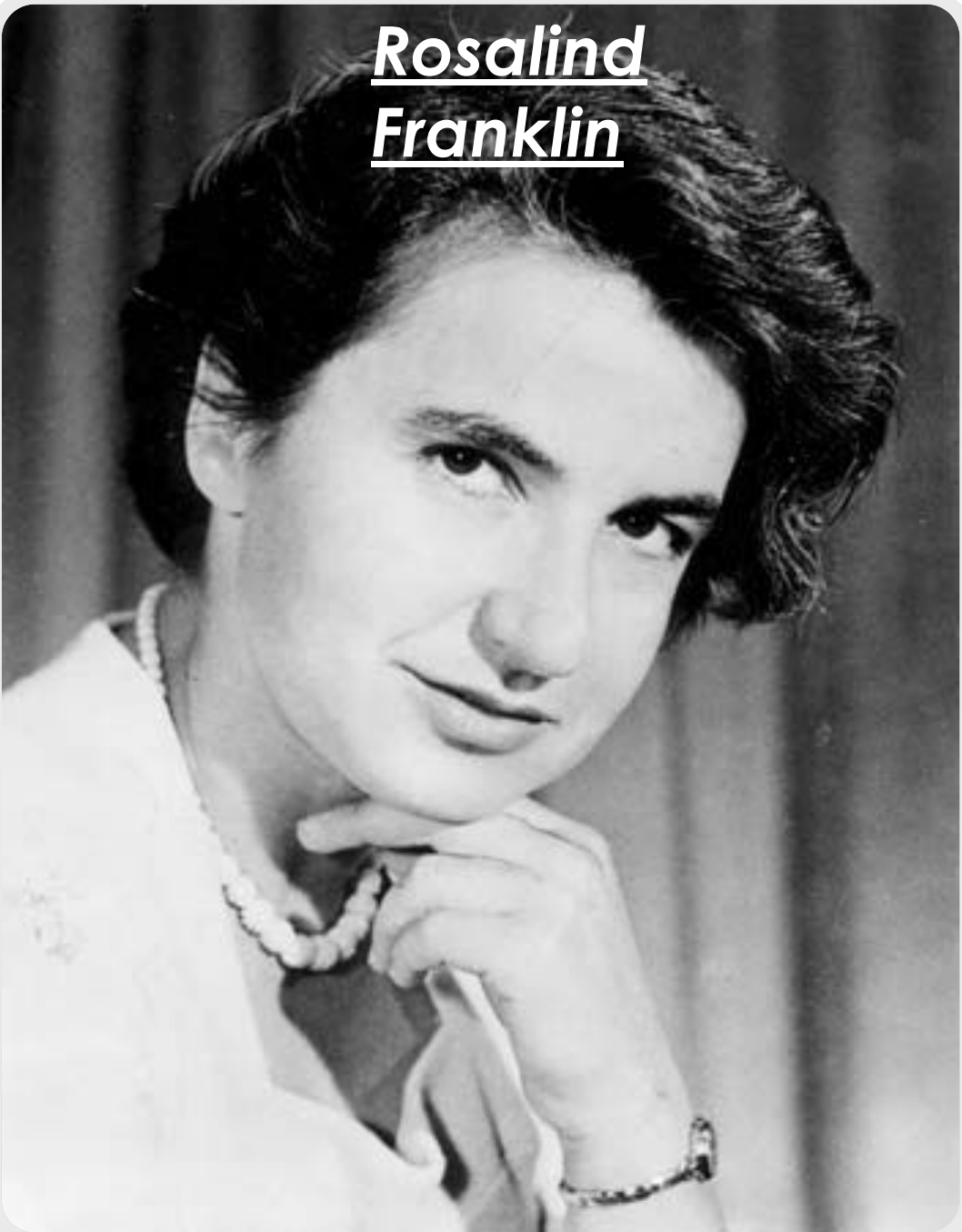


X Ray
Crystallography
Rosalind
Franklin's photo

- She made marked advances in X-ray diffraction techniques with DNA
- The diffraction pattern she obtained suggested several structural features of DNA
 - Helical
 - More than one strand
 - 10 base pairs per complete turn



Rosalind
Franklin

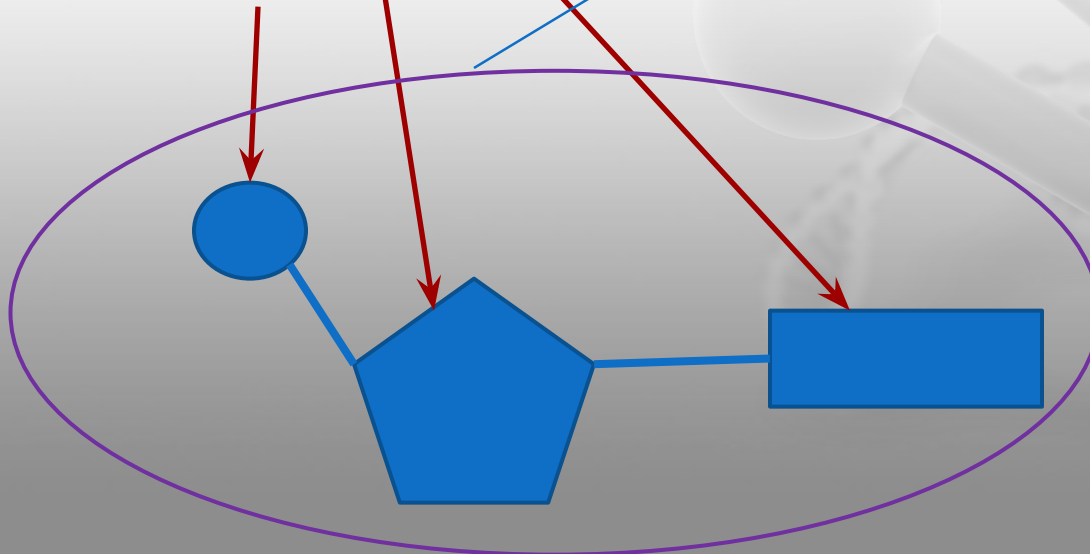


Maurice
Wilkins



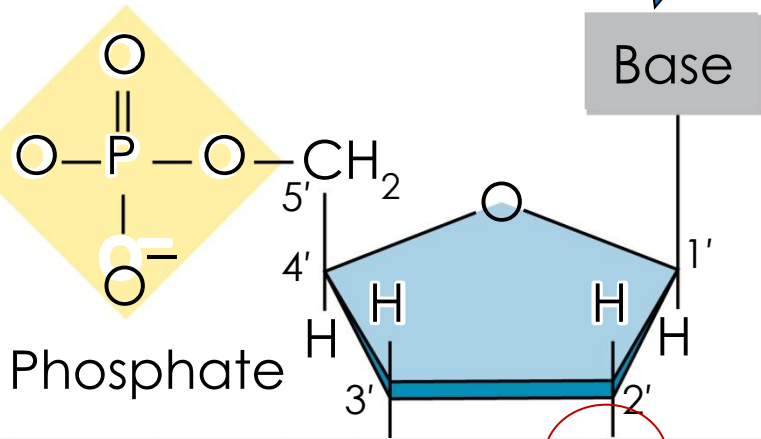
DNA Structure

- DNA structure is often divided into four different levels primary, secondary, tertiary and quaternary.
- DNA has three main components
 - 1. Deoxyribose (a pentose sugar)
 - 2. Base (there are four different ones)
 - 3. Phosphate



A, G, C or T

Base



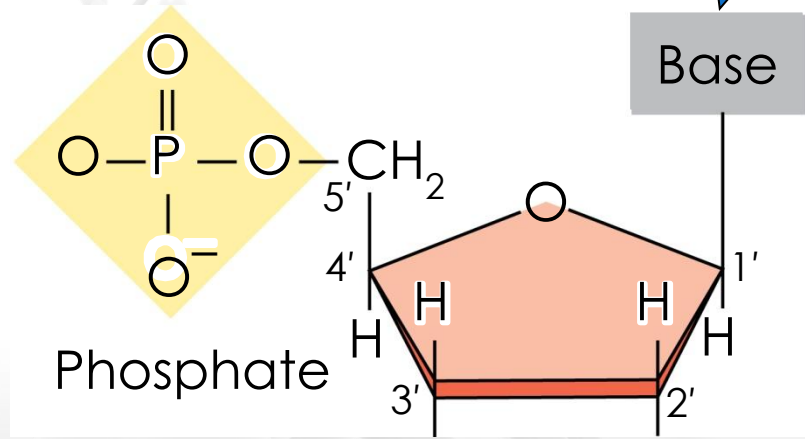
Phosphate

Deoxyribose

DNA Nucleotide

A, G, C or U

Base



Phosphate

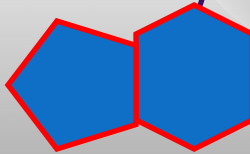
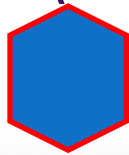
Ribose

RNA Nucleotide



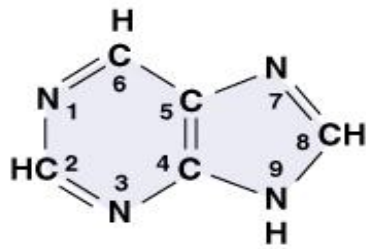
The Nitrogenous Bases

- THEY ARE DIVIDED INTO TWO GROUPS
 - Pyrimidines and purines
- PYRIMIDINES (MADE OF ONE 6 MEMBER RING)
 - Thymine
 - Cytosine
- PURINES (MADE OF A 6 MEMBER RING, FUSED TO A 5 MEMBER RING)
 - Adenine
 - Guanine
- THE RINGS ARE NOT ONLY MADE OF CARBON

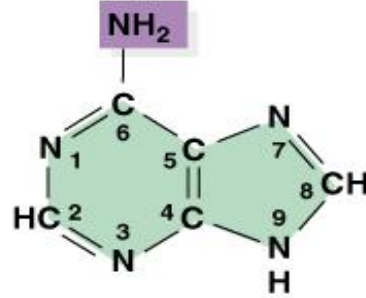




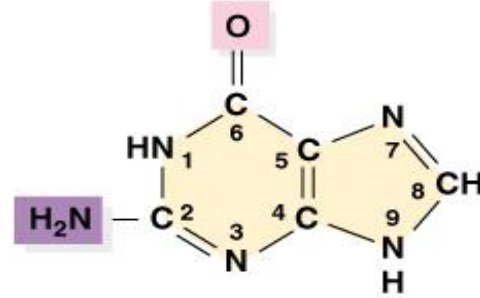
Nitrogenous bases of DNA & RNA



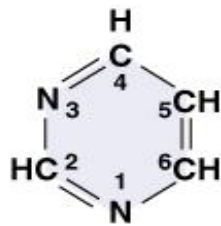
Purine
(parent compound)



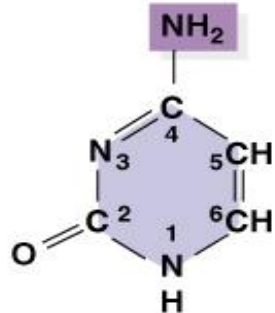
Adenine (A)



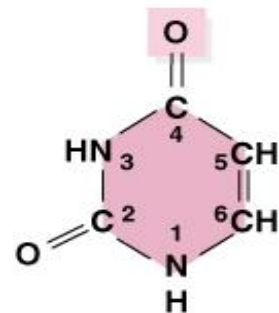
Guanine (G)



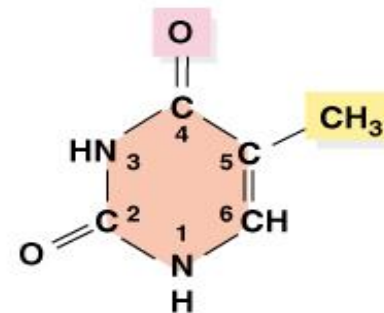
Pyrimidine
(parent compound)



Cytosine (C)



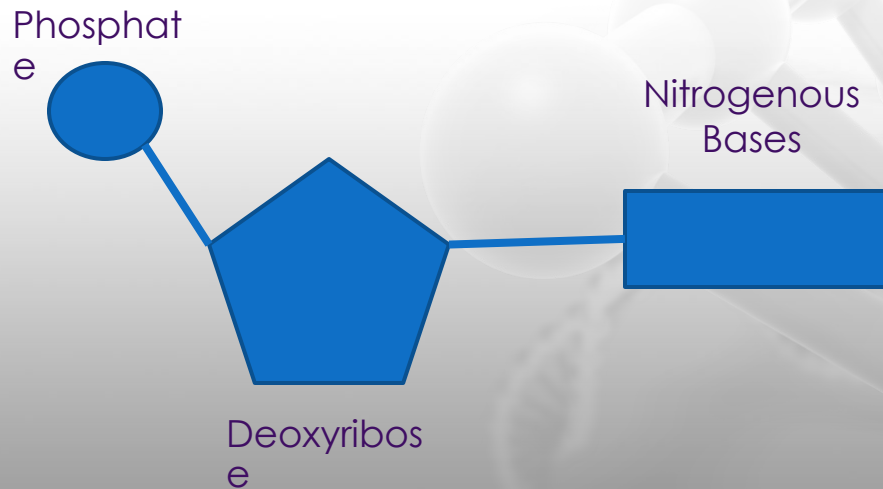
Uracil (U)
(found in RNA)

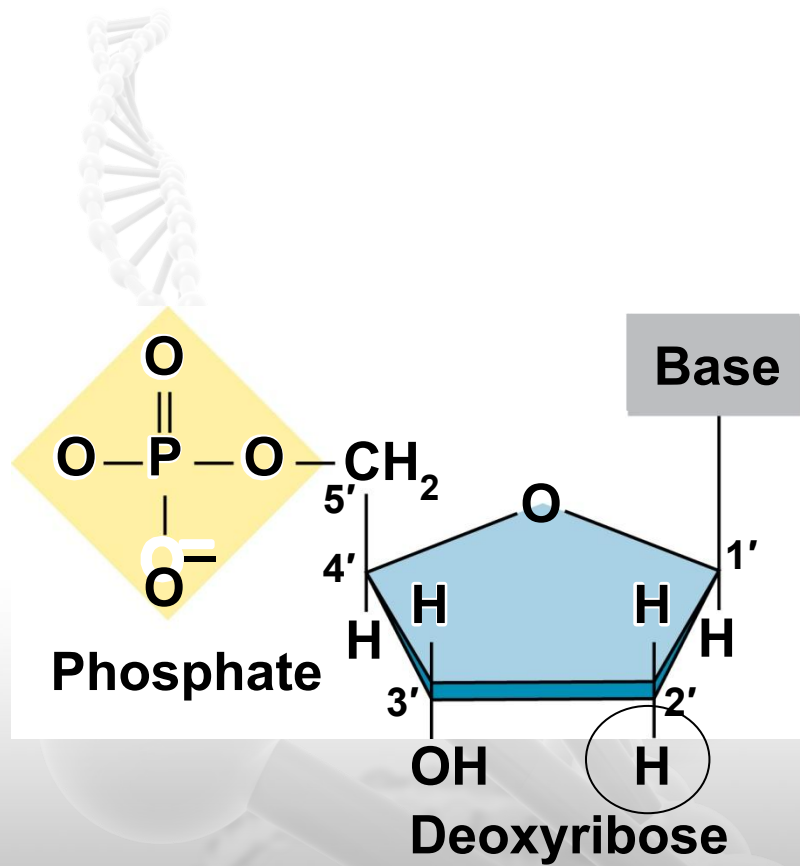
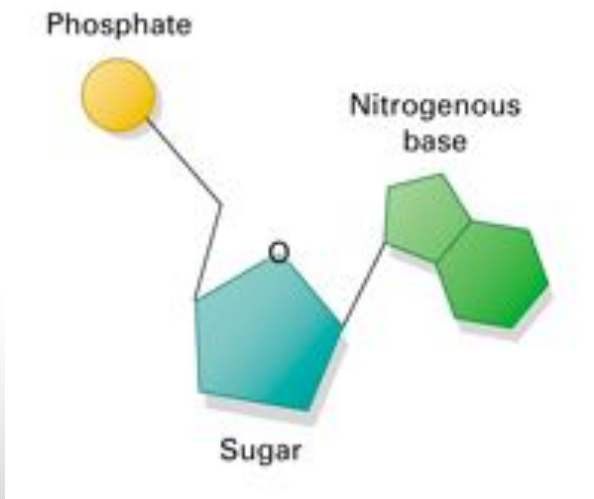


Thymine (T)
(found in DNA)

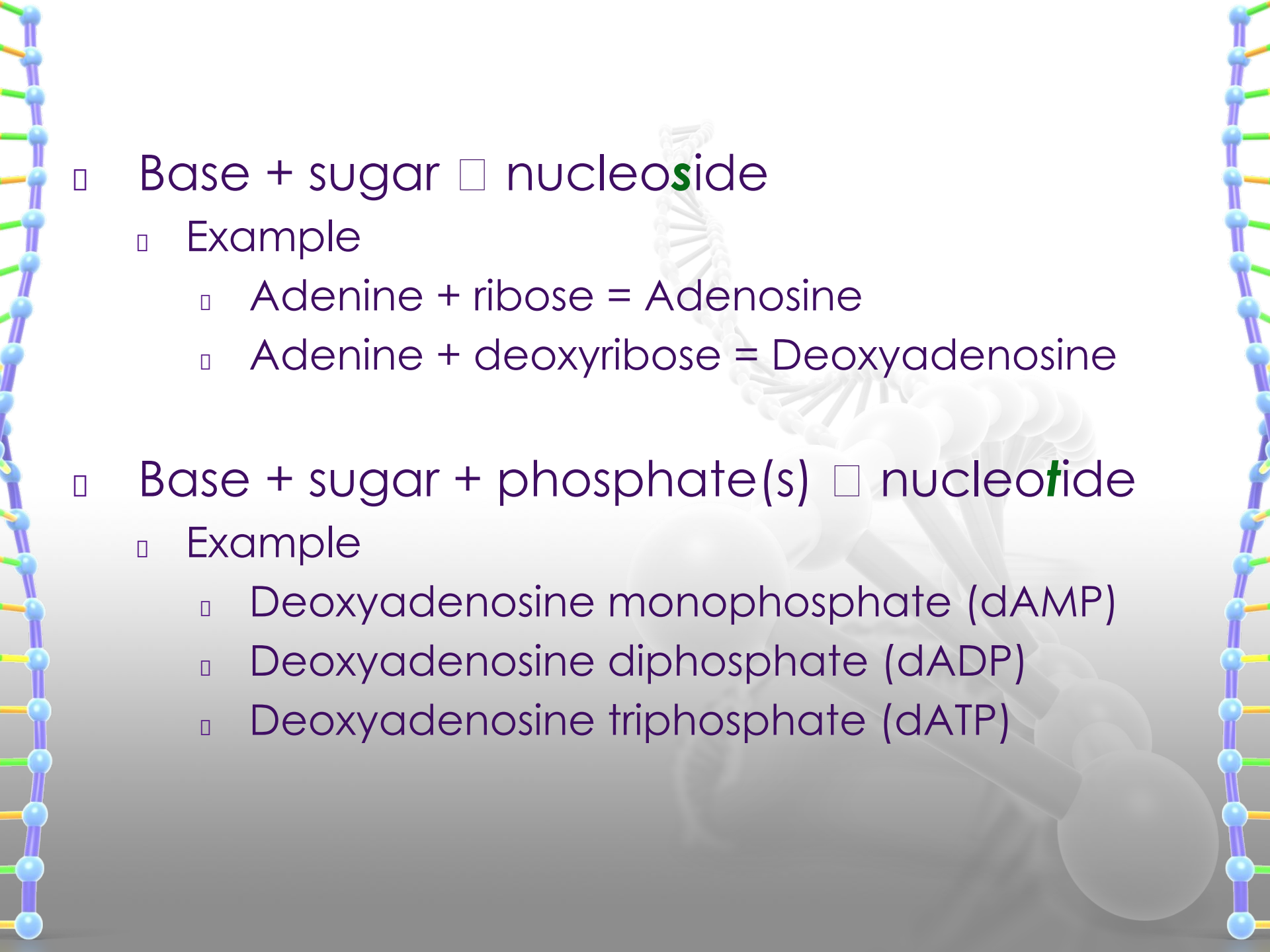
❖ Nucleotide Structure

- Nucleotides are formed by the condensation of a sugar, phosphate and one of the 4 bases
- The following illustration represents one nucleotide





DNA nucleotide



- Base + sugar □ nucleoside

- Example

- Adenine + ribose = Adenosine

- Adenine + deoxyribose = Deoxyadenosine

- Base + sugar + phosphate(s) □ nucleotide

- Example

- Deoxyadenosine monophosphate (dAMP)

- Deoxyadenosine diphosphate (dADP)

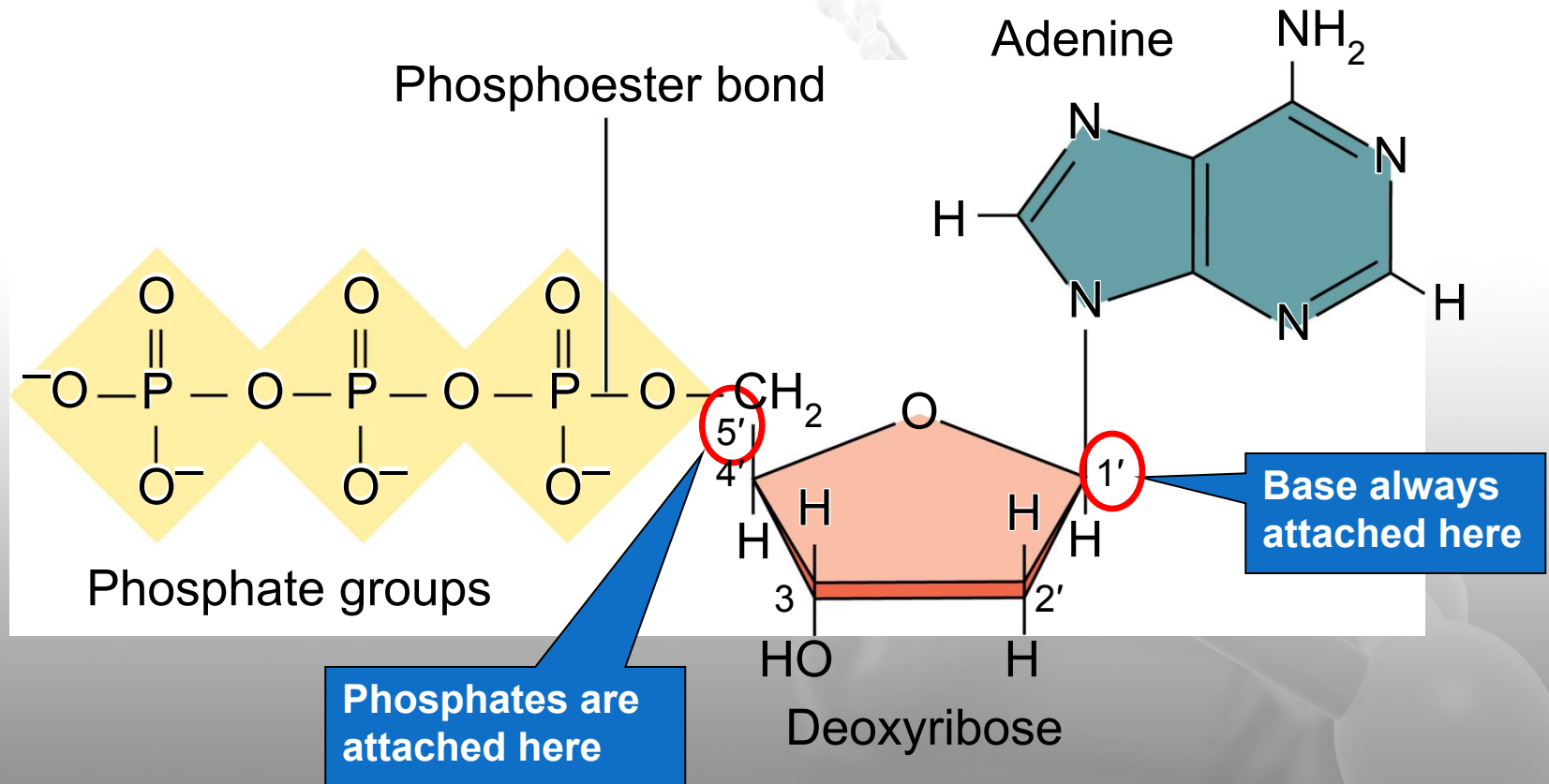
- Deoxyadenosine triphosphate (dATP)

Deoxyadenosine triphosphate

Deoxyadenosine diphosphate

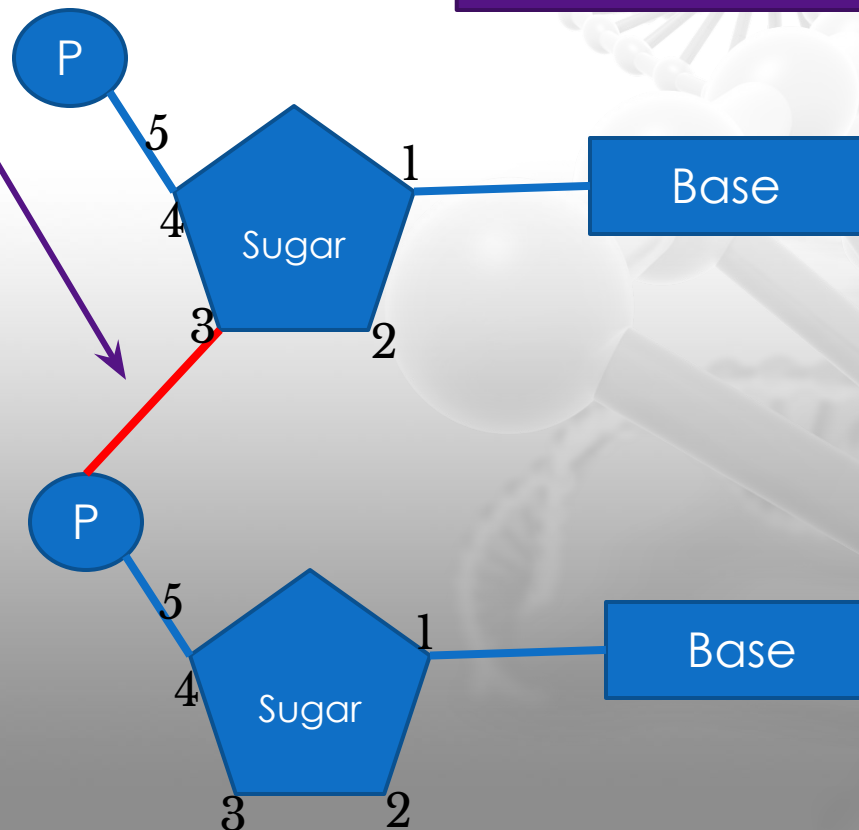
Deoxyadenosine monophosphate

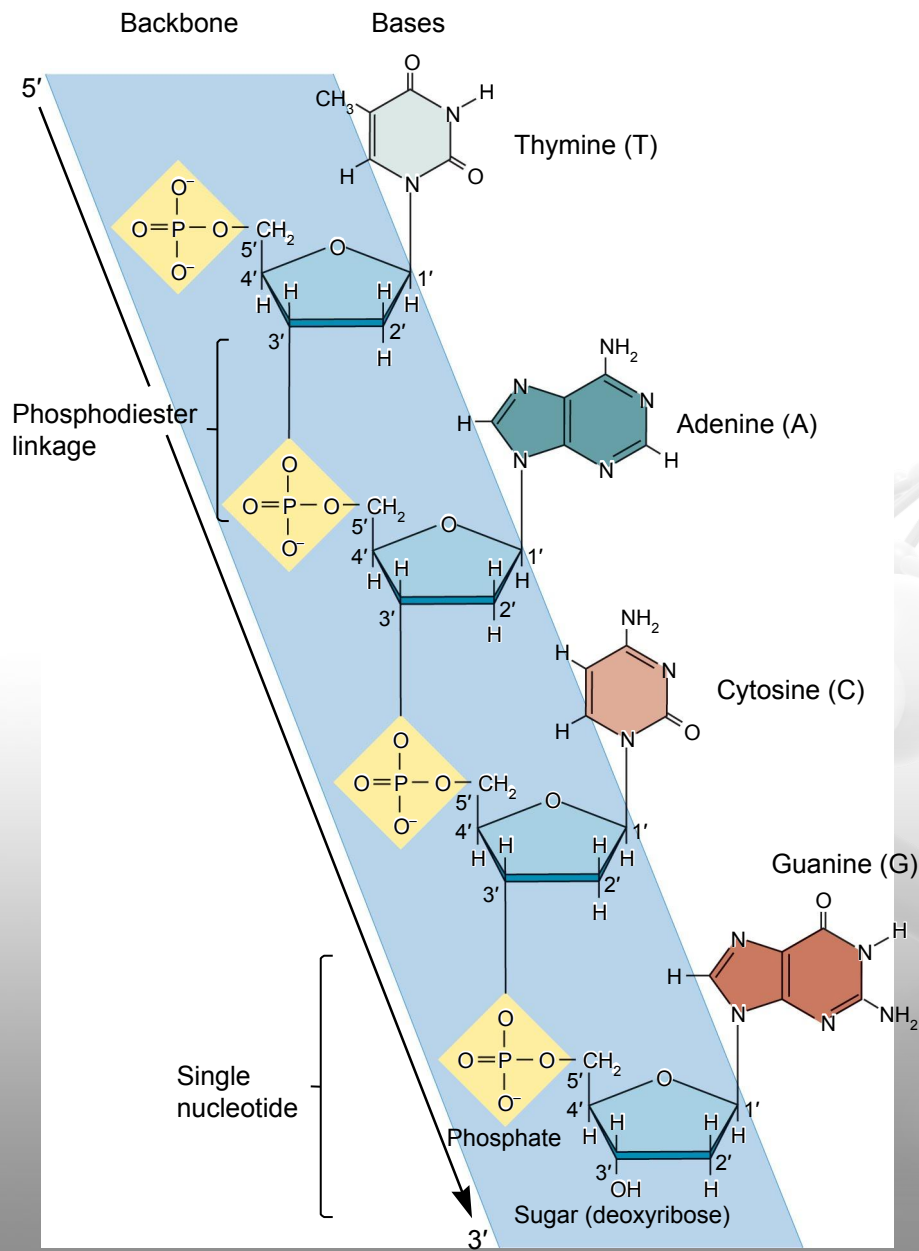
Deoxyadenosine



- Nucleotides are linked together by covalent bonds called phosphodiester linkage.

A chemical bond that involves sharing a pair of electrons between atoms in a molecule.

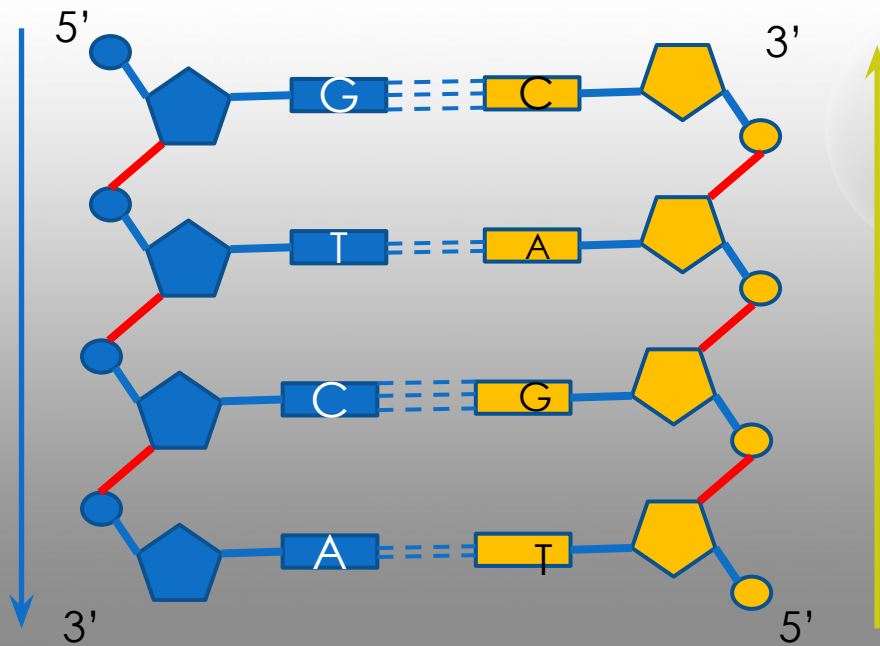


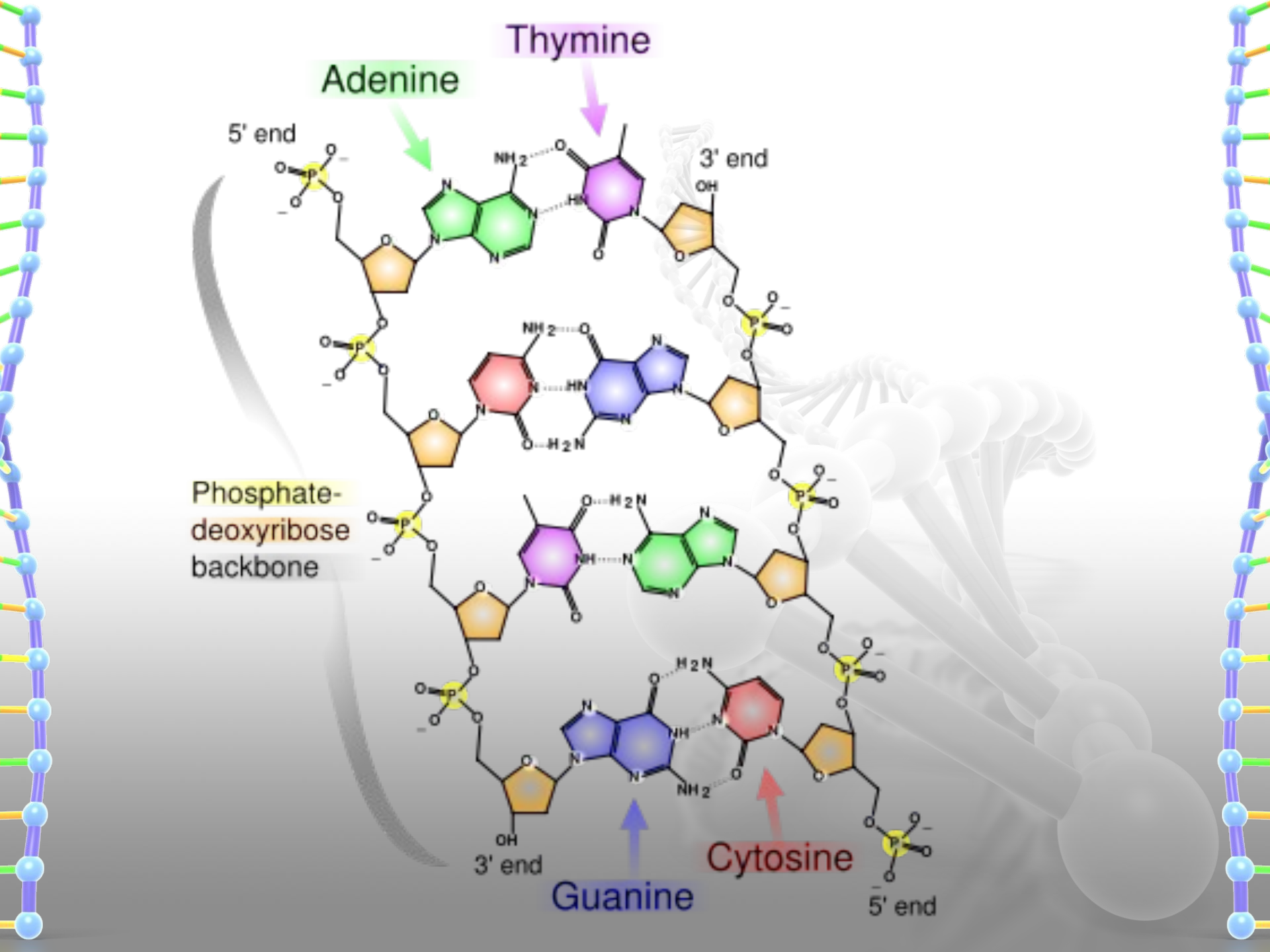


◆ DNA Double Helix & Hydrogen bonding

Salient features of the Double-helix structure of DNA:

- It is made of two polynucleotide chains, where the backbone is constituted by sugar-phosphate, and the bases project inside.
- The two chains have anti-parallel polarity. It means, if one chain has the polarity $5' \rightarrow 3'$, the other has $3' \rightarrow 5'$.





❖ DNA Double Helix & Hydrogen bonding

- The bases in two strands are paired through hydrogen bond (H-bonds) forming base pairs (bp). **Adenine** forms **two** hydrogen bonds with **Thymine** from opposite strand and vice-versa. Similarly, **Guanine** is bonded with **Cytosine** with **three** H-bonds.
- Based on the observation of **Erwin Chargaff** that for a double stranded DNA, the ratios between **Adenine** and **Thymine**; and **Guanine** and **Cytosine** are constant and equals one.
- Hydrogen bond:-A chemical bond consisting of a hydrogen atom between two electronegative atoms (e.g., oxygen or nitrogen) with one side be a covalent bond and the other being an ionic bond.

