

DNA Structure and Discovery

TEKS

- (6) Science concepts. **The student knows the mechanisms of genetics, including the role of nucleic acids** and the principles of Mendelian Genetics. The student is expected to:
- (A) identify components of DNA, and describe how information for specifying the traits of an organism is carried in the DNA;
 - (B) recognize that components that make up the genetic code are common to all organisms

Vocabulary

- Nucleic Acid
- Nucleotide
- Base pairing
- Complementary
- Template Strand
- Semiconservative

Prerequisite Questions

1. What are the monomer molecules that make up nucleic acids?
2. What are the 3 structures of a nucleotide?
3. What is the purpose of DNA?

Essential Question #1

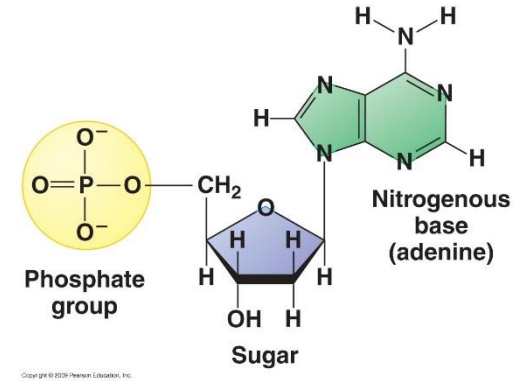
- How was DNA determined to be the hereditary molecule?

History of DNA

- 70 years ago, DNA was a mystery to most scientists
- Scientists knew of its existence, but not of its purpose.
- The following slides are just some of the major experiments that helped to define the role of DNA in biology

Erwin Chargaff (1950)

- Common knowledge that nucleotides consist of phosphate group, a sugar and a nitrogenous base.



- Compared composition of the 4 bases between many different organisms.

Source	Adenine	Guanine	Cytosine	Thymine
<i>E. coli</i>	24.7%	26.0%	25.7%	23.6%
Wheat	28.1	21.8	22.7	27.4
Sea urchin	32.8	17.7	17.3	32.1
Salmon	29.7	20.8	20.4	29.1
Human	30.4	19.6	19.9	30.1
Ox	29.0	21.2	21.2	28.7

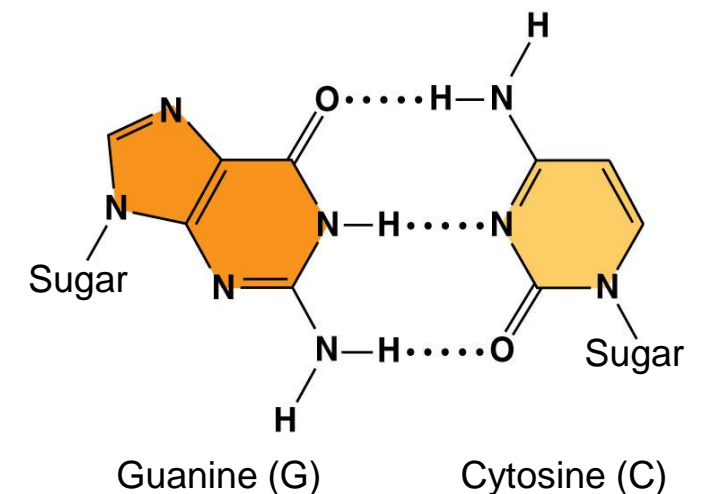
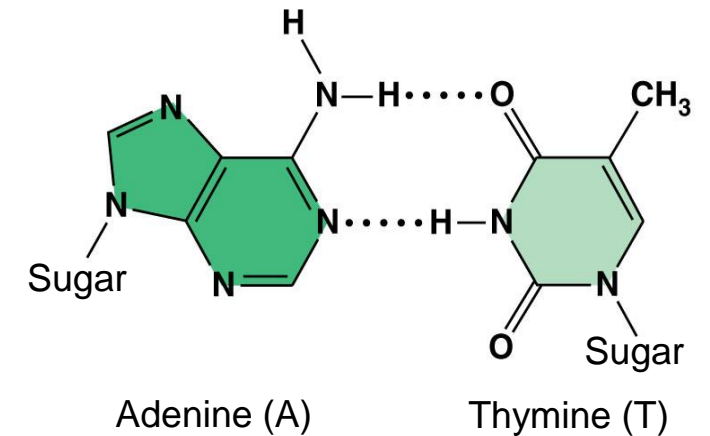
Erwin Chargaff (1950)

- Stated what we know today as **Chargaff's Rules**.

- Only certain bases pair up.

- Adenine pairs with Thymine

- Guanine pairs with Cytosine.

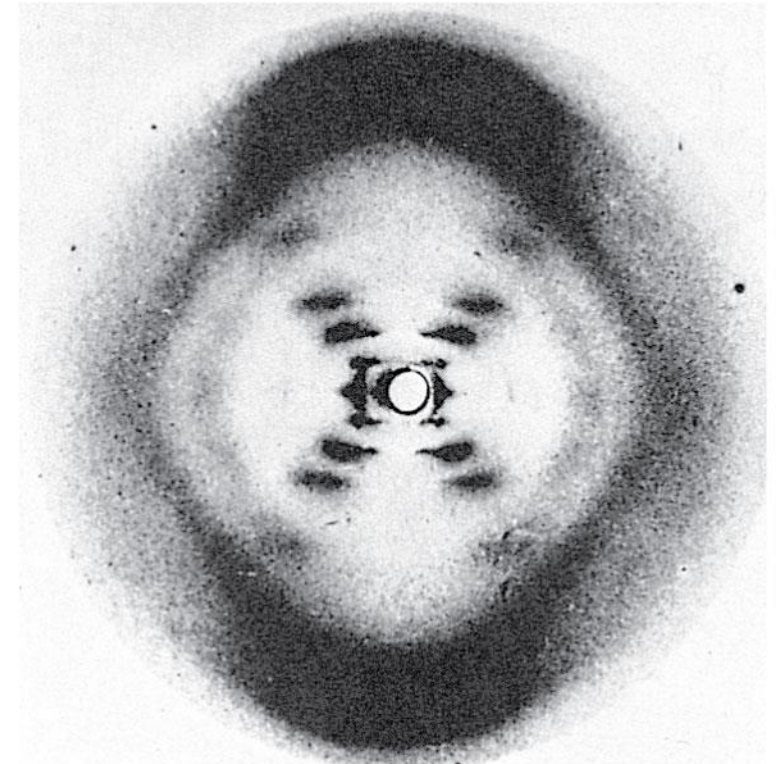


Rosalind Franklin (1952)

- Used an X-ray technique to photograph DNA
- Saw that DNA had:
 - 2 spiraling components
 - Fixed width
 - Alternating “rung” pattern



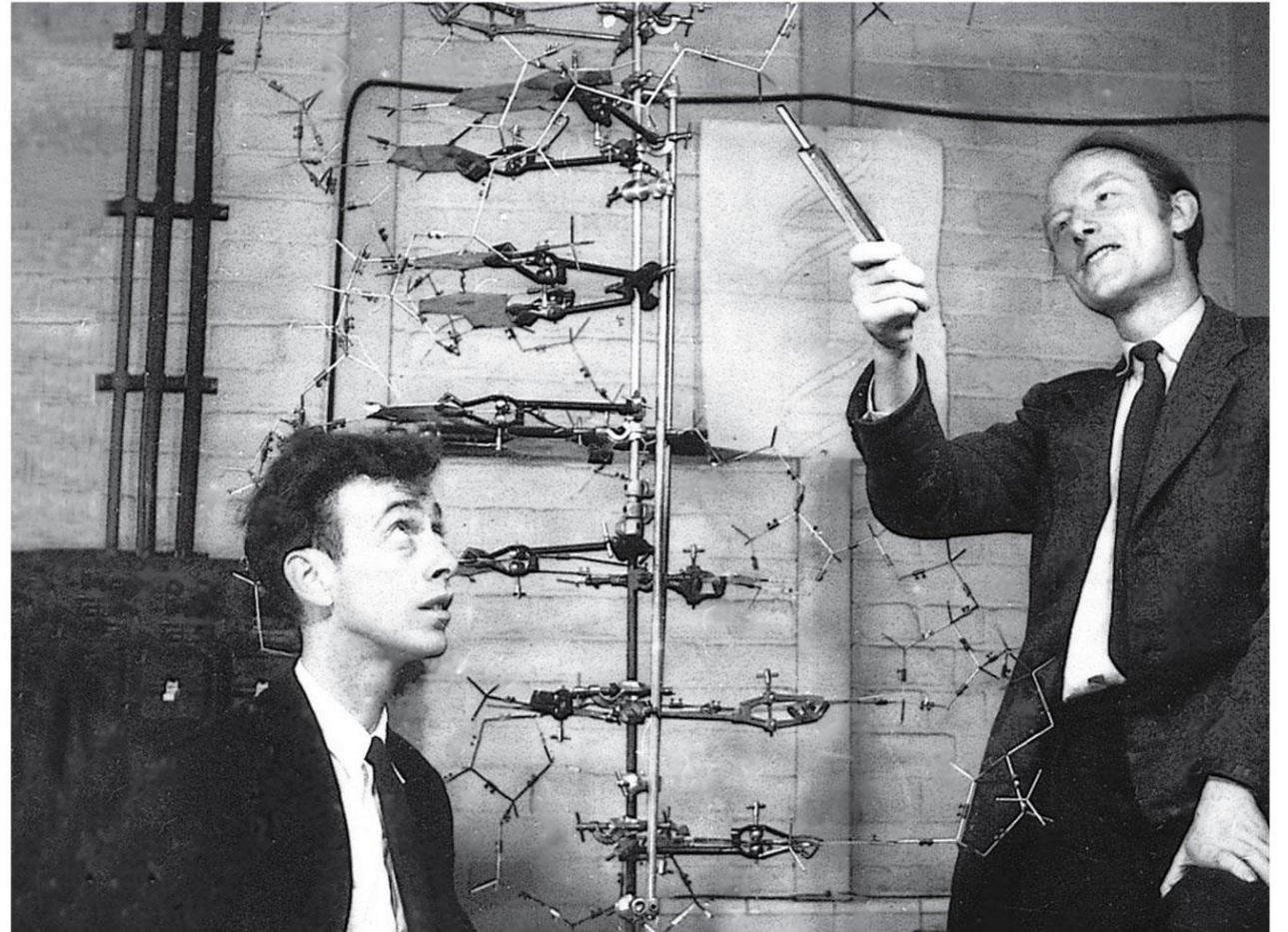
(a) Rosalind Franklin



(b) Franklin's X-ray diffraction photograph of DNA

Watson and Crick (1953)

- Used evidence from previous scientists to build a model of DNA.
- Won the Nobel prize in 1962

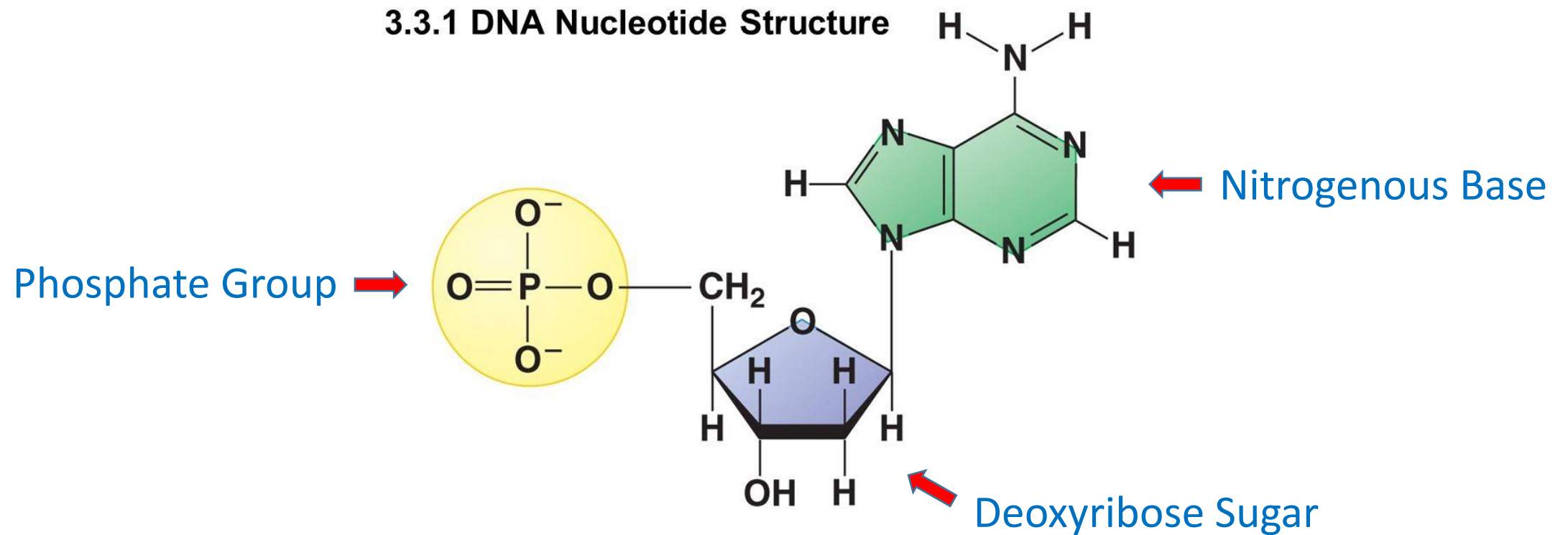


Essential Question #2

- Why is DNA replication essential to the cell cycle?

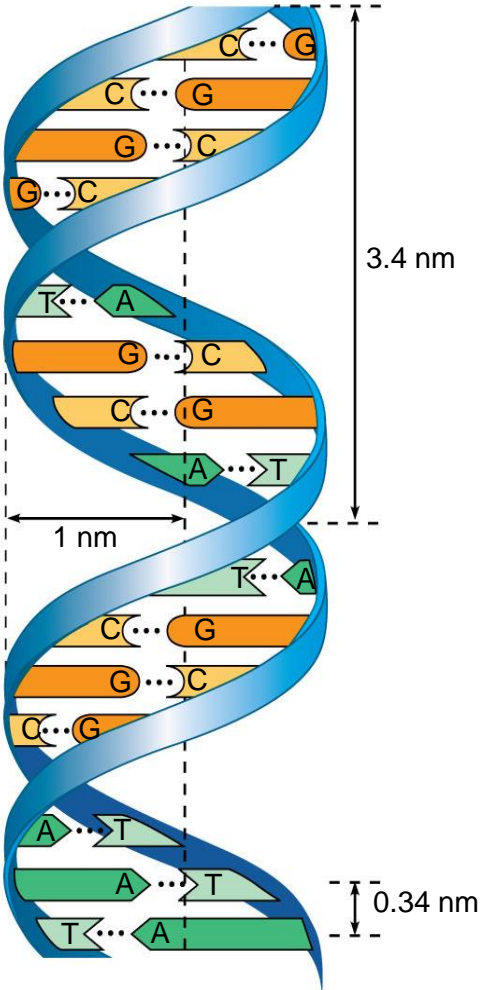
Nucleotide structure

- Nucleotides are the monomers that make up the Nucleic Acid polymer.

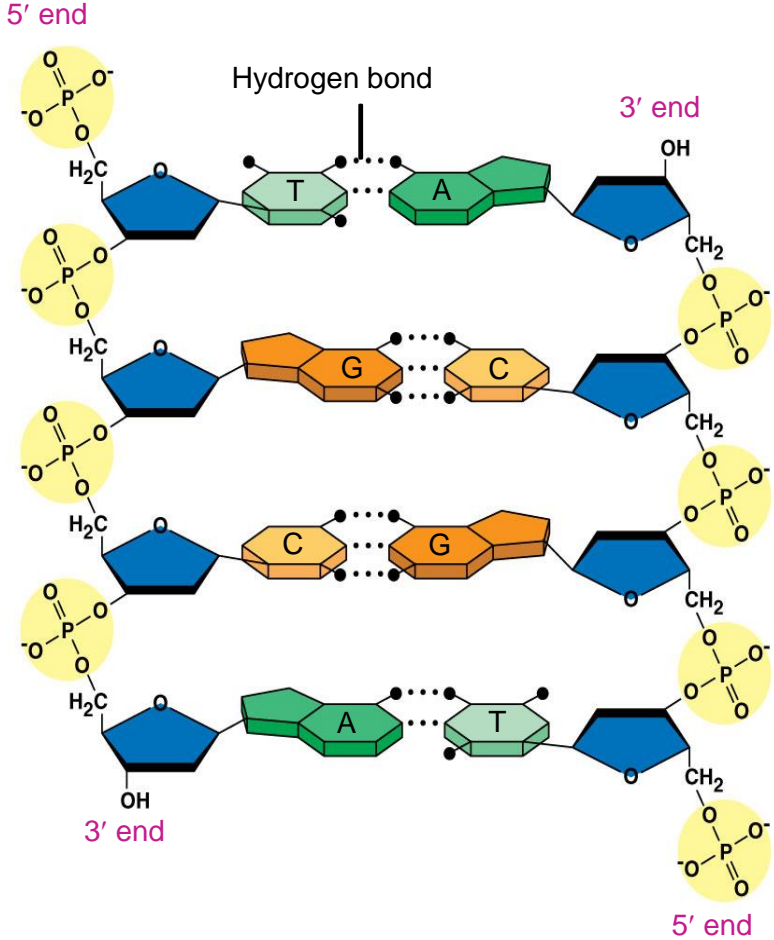


DNA structure

- DNA is a double helix
- The “backbone” is made of alternating phosphate groups and deoxyribose sugars
- The bases in the middle pair A to T and G to C



(a) Key features of DNA structure

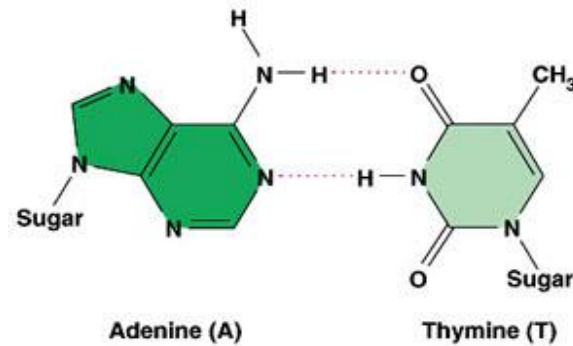


(b) Partial chemical structure

Nitrogenous Base Pairing

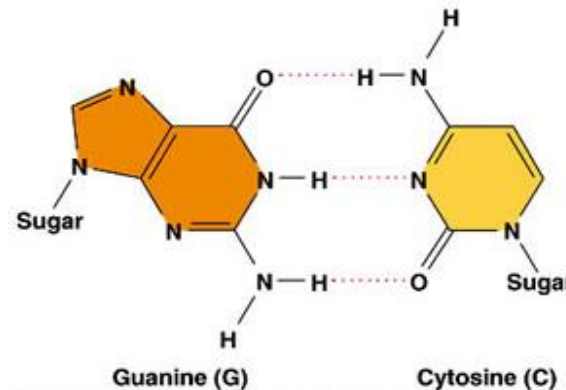
- Chargaff's Rules

Adenine pairs with Thymine



A ≡ **T**

Guanine pairs with Cytosine



G ≡ **C**

Forms of Eukaryotic DNA

- Eukaryotic DNA comes in two forms:

1) **Chromatin** – nucleic acid strands are unwound and in a “spaghetti” arrangement

- Found only during Interphase

2) **Chromosome** – nucleic acid strands are tightly wound around histone proteins, and folded on scaffolding proteins

- Found only during Mitotic stages

Prokaryote vs. Eukaryote DNA

- Prokaryotes have a single loop of DNA
- Eukaryotes have multiple strands/strings of DNA

