

## Biology 20 DNA Replication

What do the initials DNA stand for?

### DNA History:

1940's:

1947: **Chargaff**  
**Chargaff's Rule**

1950's:

Early 1950's: **Rosalind Franklin:**  
X-ray crystallography of DNA

1952: **Hershey & Chase:** (p. 185; Fig. 10.1)  
Discovered DNA is the genetic material of bacteriophages (p. 183; Fig. 10.0)  
Bacteriophages are viruses that infect bacteria (bacteria eaters)  
Conclusions: viral DNA injected into bacteria, which made more viruses

1953: **Watson & Crick:**  
Used information from Franklin's X-ray photos to make a wire scale model  
Conclusions:

Late 1950's: **Messelson & Stahl**  
Working with bacteria (*E. coli*)  
Confirmed Watson & Crick's model for DNA replication

### Brief review of DNA structure:

DNA is a polymer of?

Components of a nucleotide: (p. 186; Fig. 10.2A)

- a)
- b)
- c)

Two classes of nitrogenous bases: (p. 187; Fig. 10.2 B & C)

a) **Purines**

- 1)
- 2)

b) **Pyrimidines**

- 1)
- 2)
- 3)

Which nitrogenous base is only found in RNA?

Which nitrogenous base is only found in DNA?

Which nitrogenous bases are found in both DNA and RNA?

**Base pairing of nitrogenous bases (Chargaff's Rule):**

<u>Purines</u>	<u>Pyrimidines</u>	<u>Base pairs</u>	<u># of H-bonds</u>
Adenine (A)	Thymine (T)	A = T	
Guanine (G)	Cytosine (C)	G ≡ C	

Adenine comprises 20% of the nitrogenous bases in the DNA of a particular organism. What percentage does cytosine comprise?

DNA structure:

Double helix - shaped like a ladder (p. 189; Fig. 10.3C)

- a) Backbone (legs) of the ladder composed of:
- b) Rungs of the ladder composed of:

Double helix: 2 nm, suggested 2 strands  
10 nucleotide pairs in each helix turn

DNA strands are **antiparallel** (p. 191; Fig. 10.5B)

Why would a cell undergo DNA replication?

What phase of the cell cycle does DNA replication take place? (p. 131; Fig. 8.5)

## **DNA Replication (synthesis):**

### **Enzymes involved in DNA replication:**

- 1) helicase:
- 2) single strand binding protein:
- 3) primase:
- 4) DNA polymerase:    a)  
                                  b)  
                                  c)
- 5) DNA ligase:

### **Origins of replication:** (p. 191; Fig. 10.5A)

#### **Replication bubble:**

Eukaryotes: thousands of replication bubbles  
Why?

#### **Replication Fork:** (p. 191; Fig. 10.5C)

Replication bubble creates a Y-shaped region

Replication will spread in both directions:

#### **Priming for DNA Replication:**

Before DNA polymerase can begin work on the daughter strands, a primer must be laid first.

Which enzyme produces the primer?

What type of molecule is the primer?

#### **Synthesis of the new DNA strands:**

Once the RNA primers are in place, DNA polymerase can go to work.

DNA polymerase catalyses the synthesis of the new strands:

Direction of synthesis: \_\_\_\_\_

Why?

#### **Leading strand:**

A different DNA polymerase will come and convert the RNA primer to DNA nucleotides

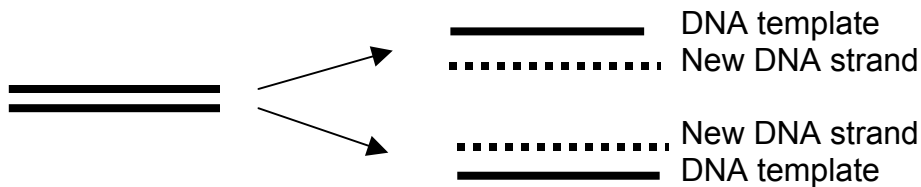
**Lagging strand:**

**Okazaki's fragments:**

Role of DNA ligase:

**Semi-conservative model for DNA Replication:**

Watson & Crick suggested & Messelson & Stahl confirmed:



**Proofreading:**

**DNA Repair:**

Damage to DNA through:

Excision repair:

**DNA Technology:**

**Recombinant DNA technology:**

- Use plasmid (small circular DNA) from bacteria
- Insert the gene of interest into the plasmid
- Put plasmid back into bacteria
- Allow bacteria to replicate => many copies of that gene
- Isolate gene and transfer into other organisms
  - Ex. Gene for pest resistance inserted into plants
  - Gene used to alter bacteria for cleaning up toxic waste

Protein dissolves blood clots in heart attack therapy  
Human growth hormone treats stunted growth

**Polymerase Chain Reactions (PCR):** p. 242; Fig. 12.12

Analysis of DNA from different sources:

**Restriction Fragment Length Polymorphism (RFLP):**

**Restriction enzymes:**

Use of RFLP's: