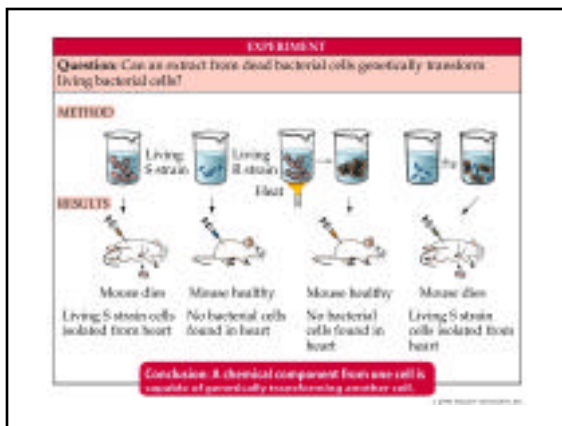


Chapter 11

The structure, replication, and repair
of DNA



Smooth versus rough colonies of *Streptococcus*
(*Diplococcus*) *pneumoniae*

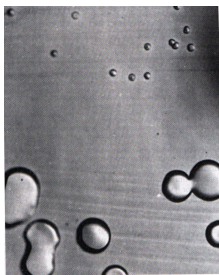
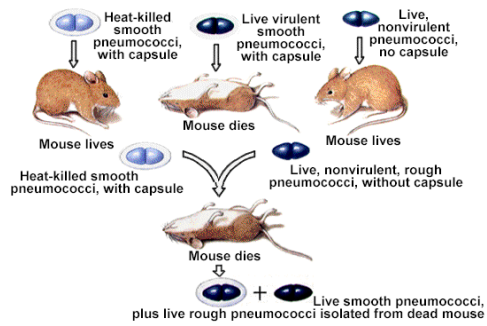
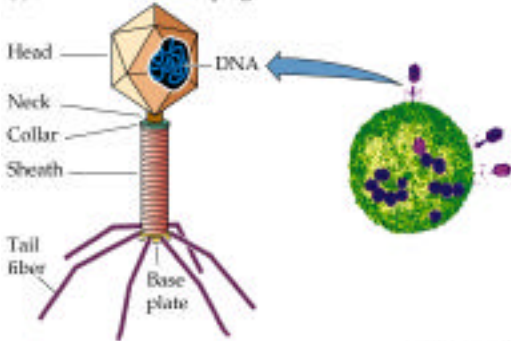


FIGURE 14.5
Transformation of *Streptococcus*. This photo, from the original publication of Avery and coworkers, shows the transformation of nonpathogenic K *Streptococcus* (the small colonies) to pathogenic S *Streptococcus* (the large colonies) in an extract prepared from heat-killed S *Streptococcus*.

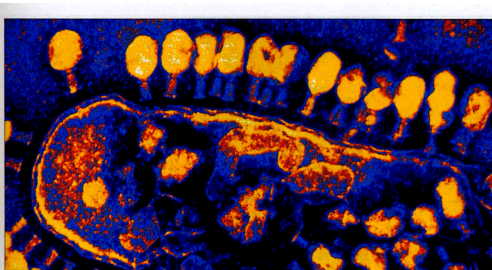
Griffith's experiment (1920s)



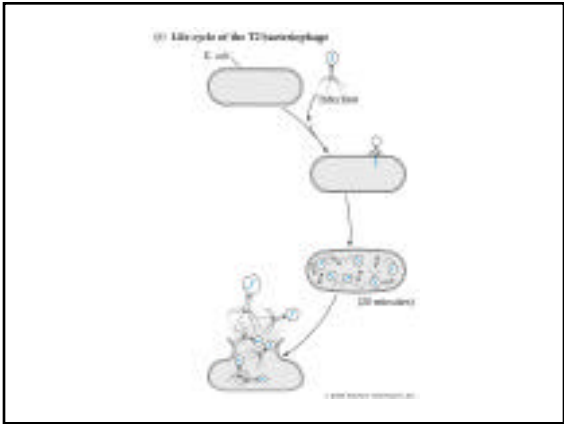
(a) The virus: T2 bacteriophage

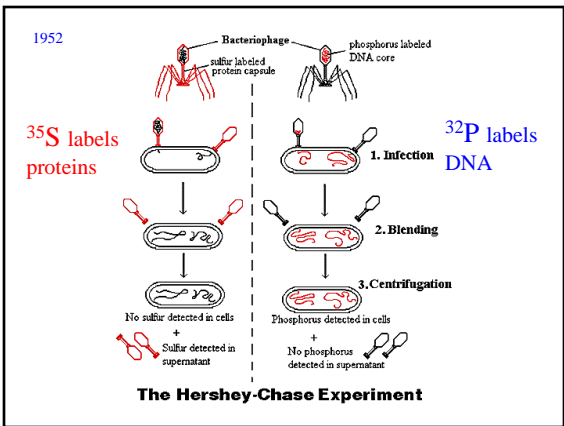


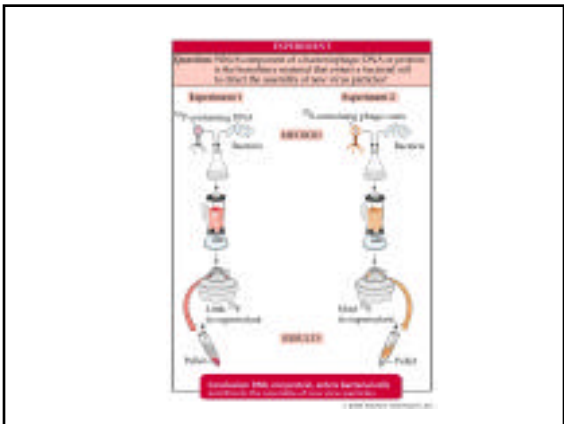
T2 phages



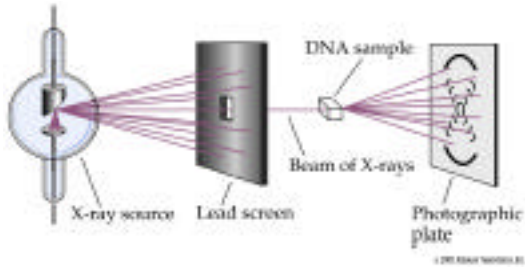
a The micrograph shows T2 bacteriophages infecting an *E. coli* cell.



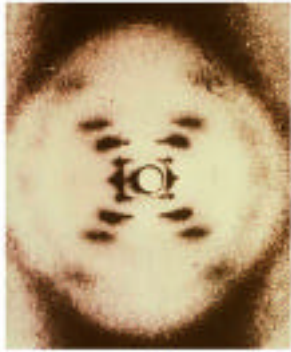




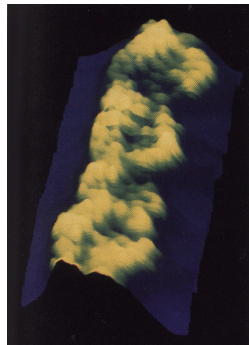
X-ray diffraction



Rosalind Franklin's X-ray diffraction of DNA

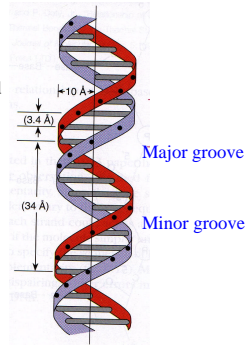


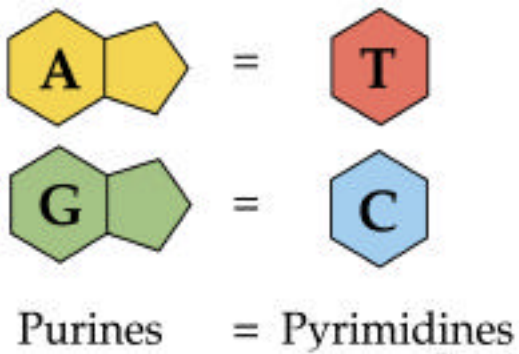
Scanning tunneling microscopy



Watson & Crick DNA structure

Right-handed double helix
 Antiparallel
 Bases are stacked - 3.4 Å
 Nitrogenous bases are H-bonded
 One complete turn every 10
 bases or 34 Å
 Major groove and minor groove
 Double helix measures 20 Å in
 diameter

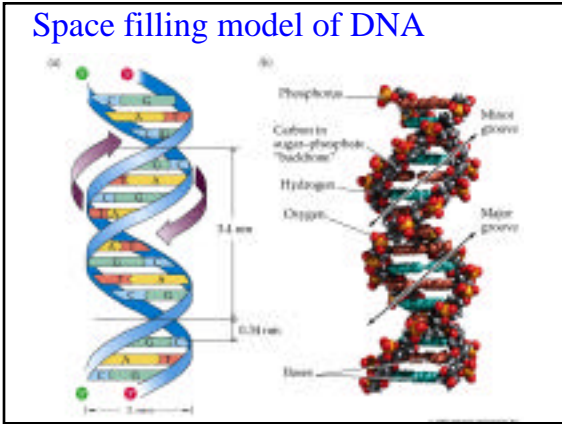




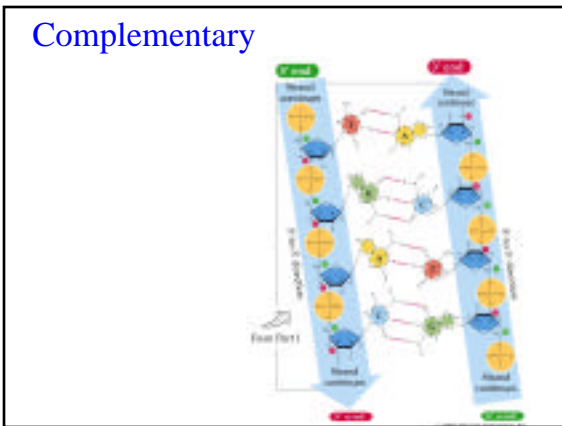
11.1 Percentages of Bases in the DNA of Some Well-Studied Species

DNA ORIGIN	AMOUNT OF BASE (PERCENTAGE OF TOTAL DNA)			
	A	T	G	C
Human (<i>Homo sapiens</i>)	31.0	31.5	19.1	18.4
Corn (<i>Zea mays</i>)	25.6	25.3	24.5	24.6
Fruit fly (<i>Drosophila melanogaster</i>)	27.3	27.6	22.5	22.5
Bacterium (<i>Escherichia coli</i>)	26.1	23.9	24.9	25.1

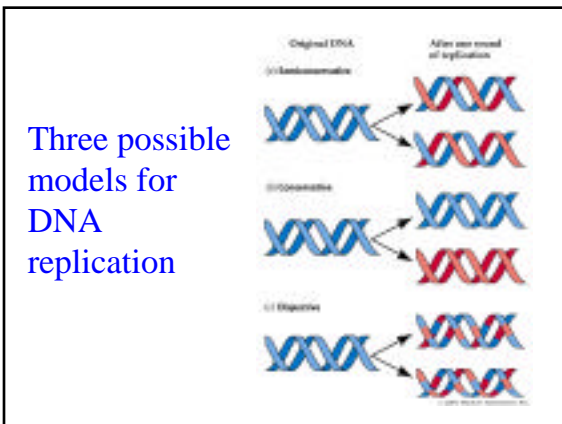
Space filling model of DNA



Complementary

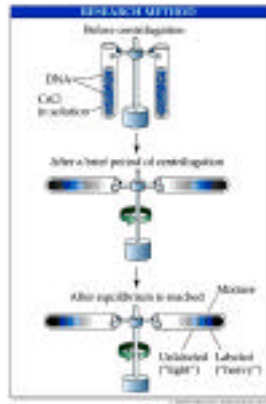


Three possible models for DNA replication

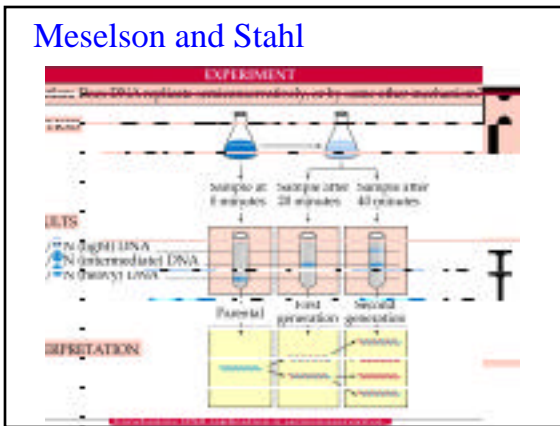


Centrifuging DNA

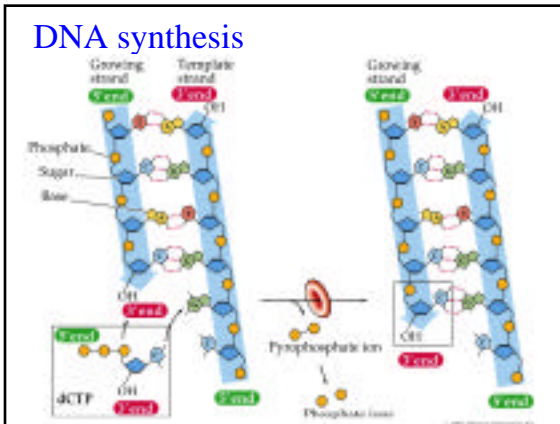
Svedberg coefficient (S)

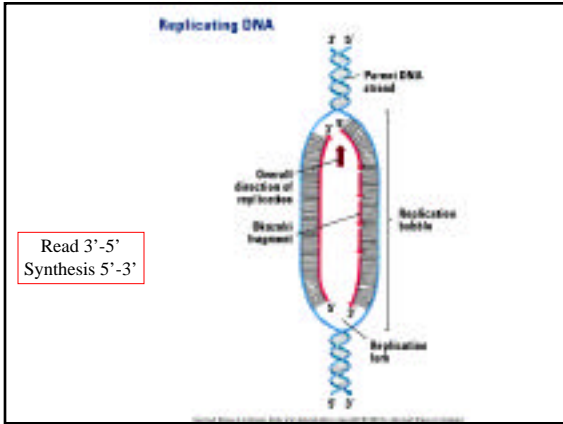


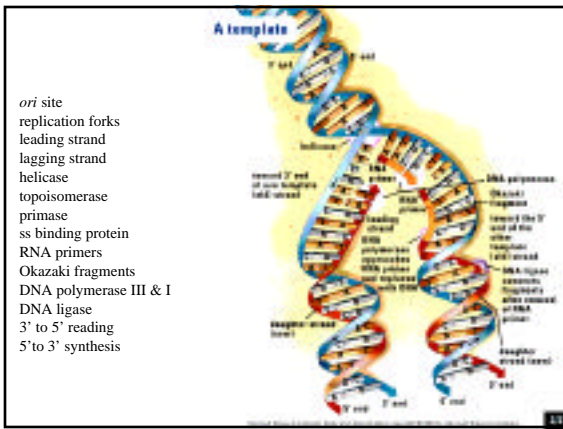
Meselson and Stahl



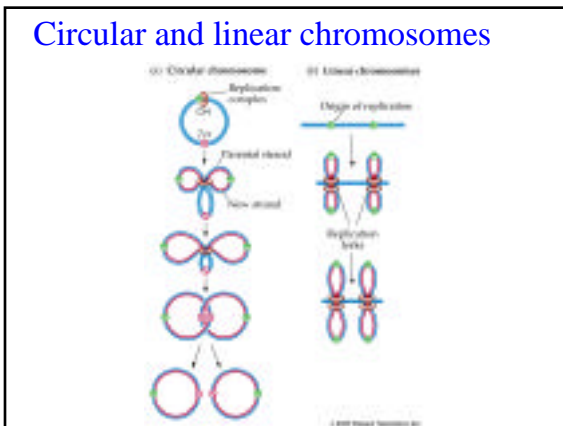
DNA synthesis





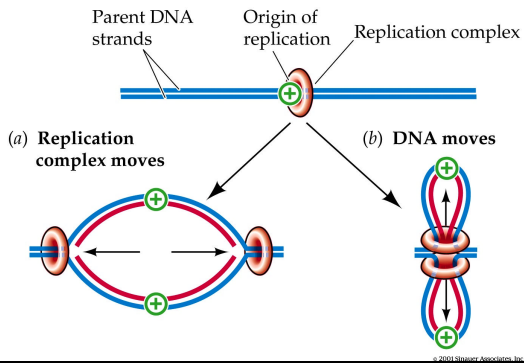


ori site
replication forks
leading strand
lagging strand
helicase
topoisomerase
primase
ss binding protein
RNA primers
Okazaki fragments
DNA polymerase III & I
DNA ligase
3' to 5' reading
5' to 3' synthesis

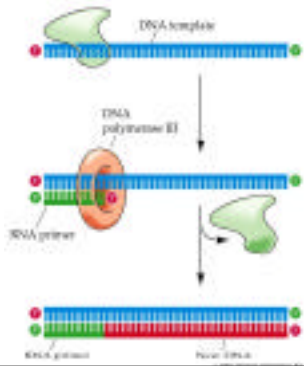


Circular and linear chromosomes

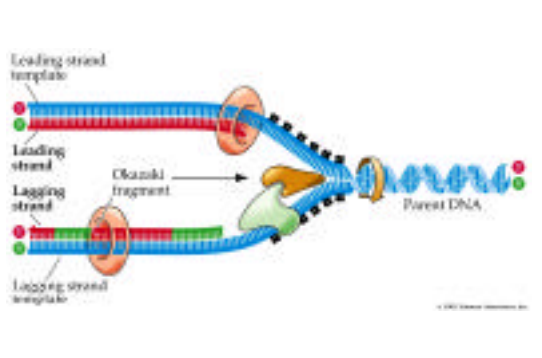
Two ideas of DNA replication



Primer and a polymerase



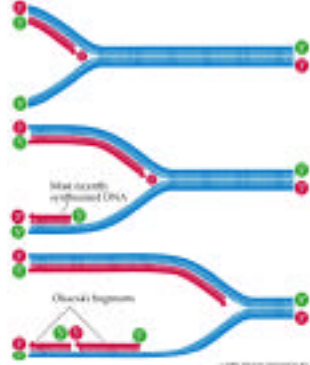
Holoenzyme complex



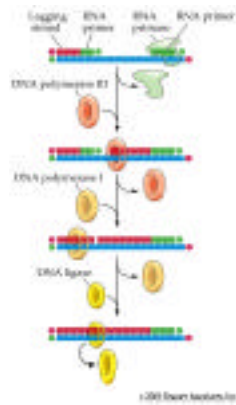
Lagging strand

Okazaki fragments

Gaps are filled in by Pol I and DNA ligase



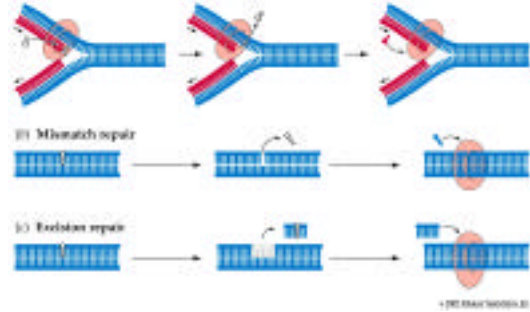
The lagging strand



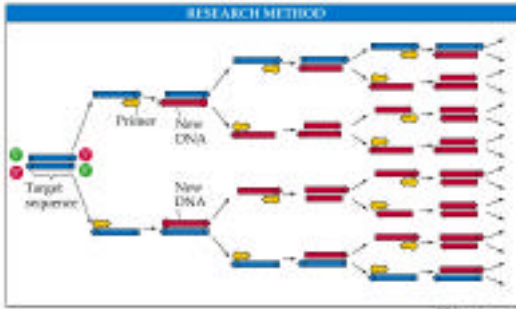
(a) DNA proofreading

(b) Mismatch repair

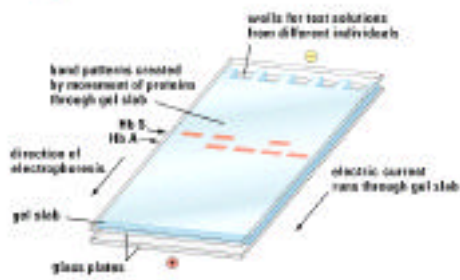
(c) Excision repair



Polymerase chain reaction



Electrophoresis



Mutations

- Point mutations
 - Base substitutions
 - Insertion
 - Deletion
- Chromosomal mutations
 - Deficiencies
 - Translocations
 - Inversions
 - Duplications
 - Aneuploidy
 - Trisomy
 - monosomy
