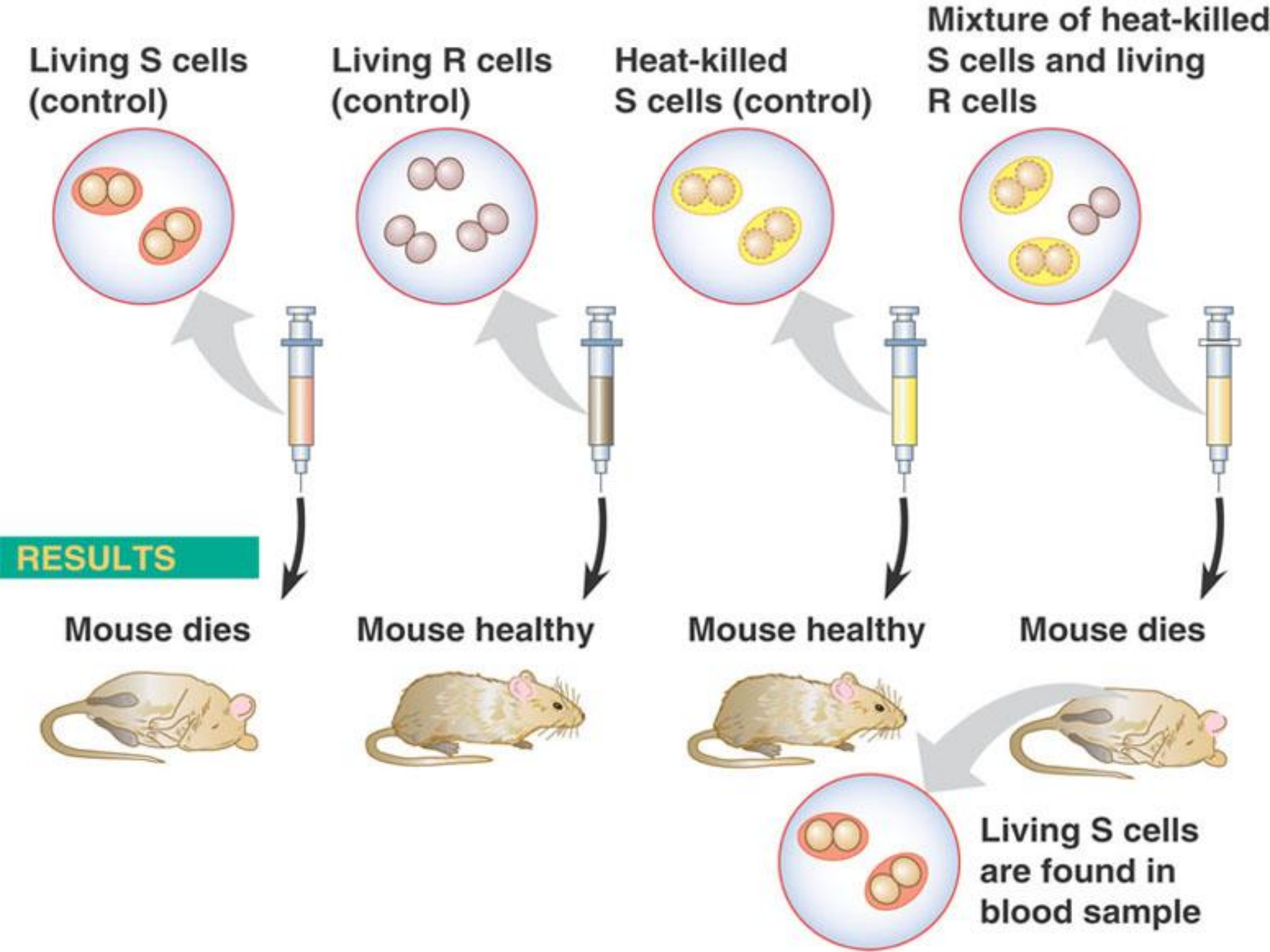
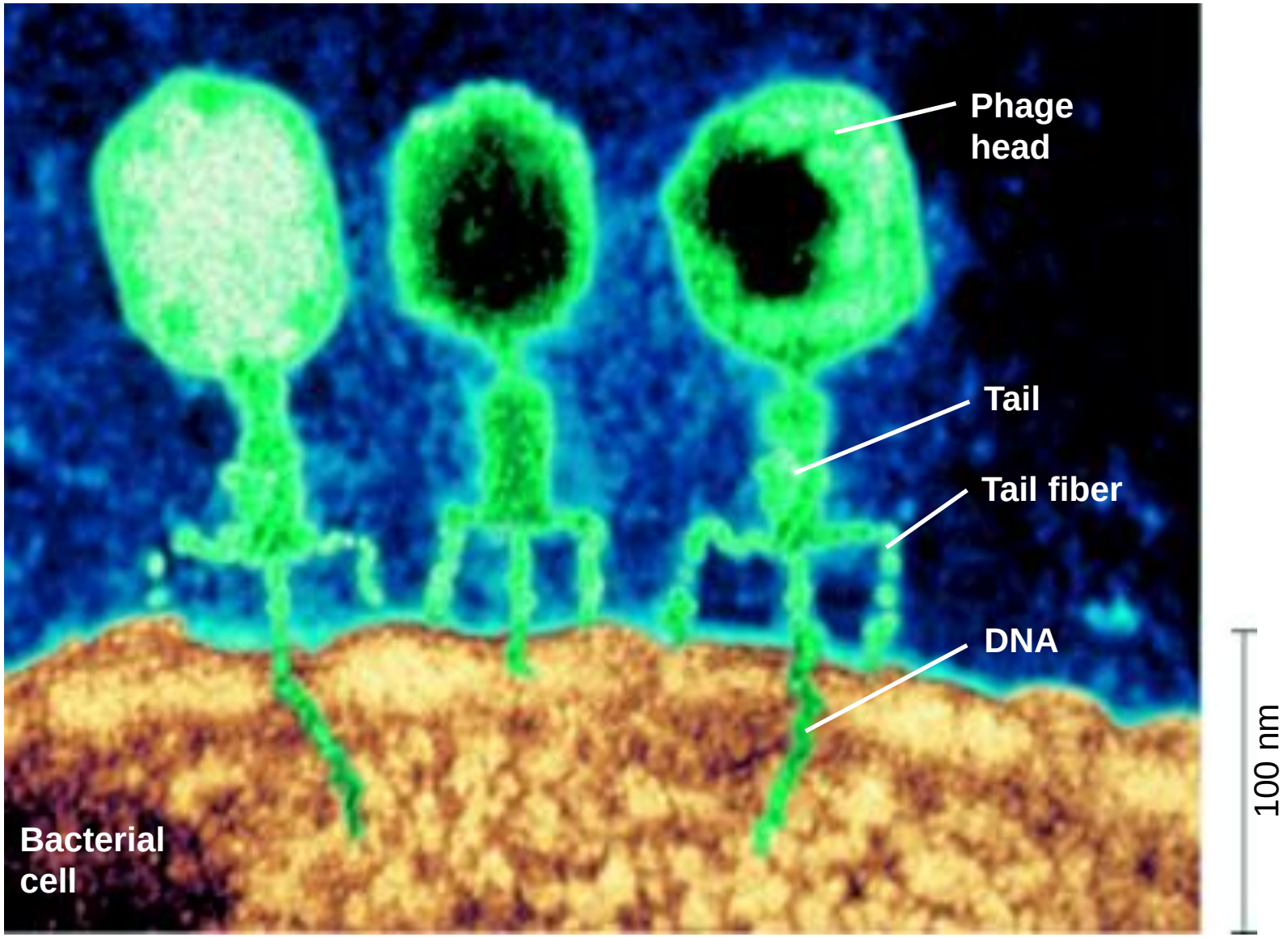
The Molecular basis of Inheritance


Living S cells (control)
Living R cells (control)
Heat-killed S cells (control)
Mixture of heat-killed S cells and living R cells
RESULTS
Mouse dies
Mouse healthy
Mouse healthy
Mouse dies
Living S cells are found in blood sample

- Griffith called the phenomenon transformation
  - Now defined as a change in genotype and phenotype due to the assimilation of external DNA by a cell

Bacteriophages



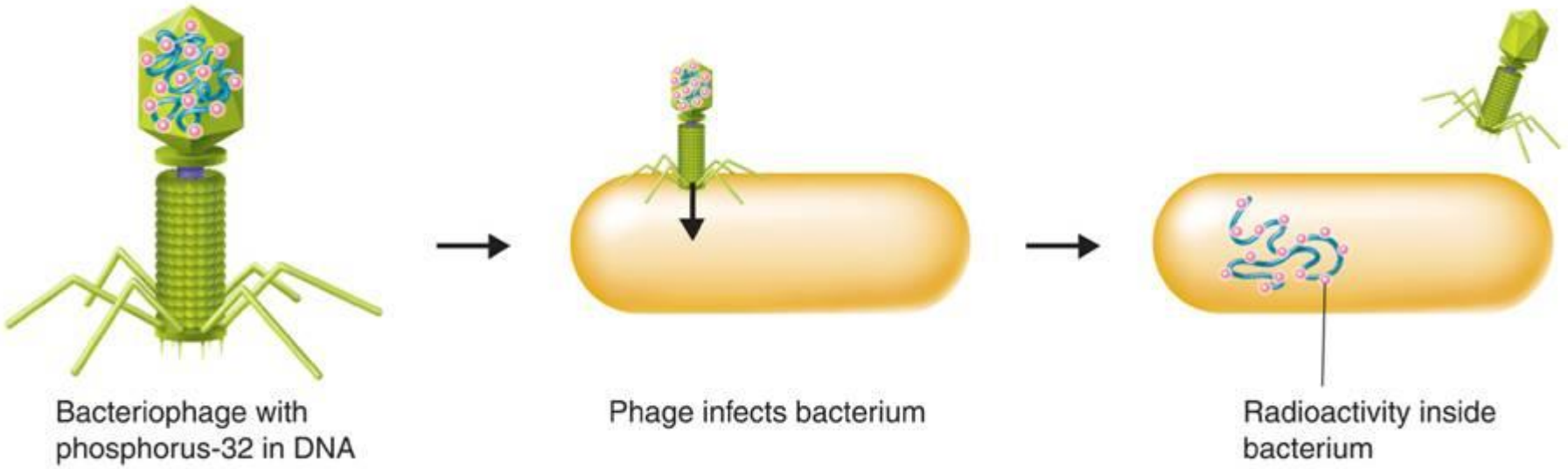
re 16.3

The Hershey-Chase Experiment

Alfred Hershey and Martha Chase studied viruses—nonliving particles smaller than a cell that can infect living organisms.

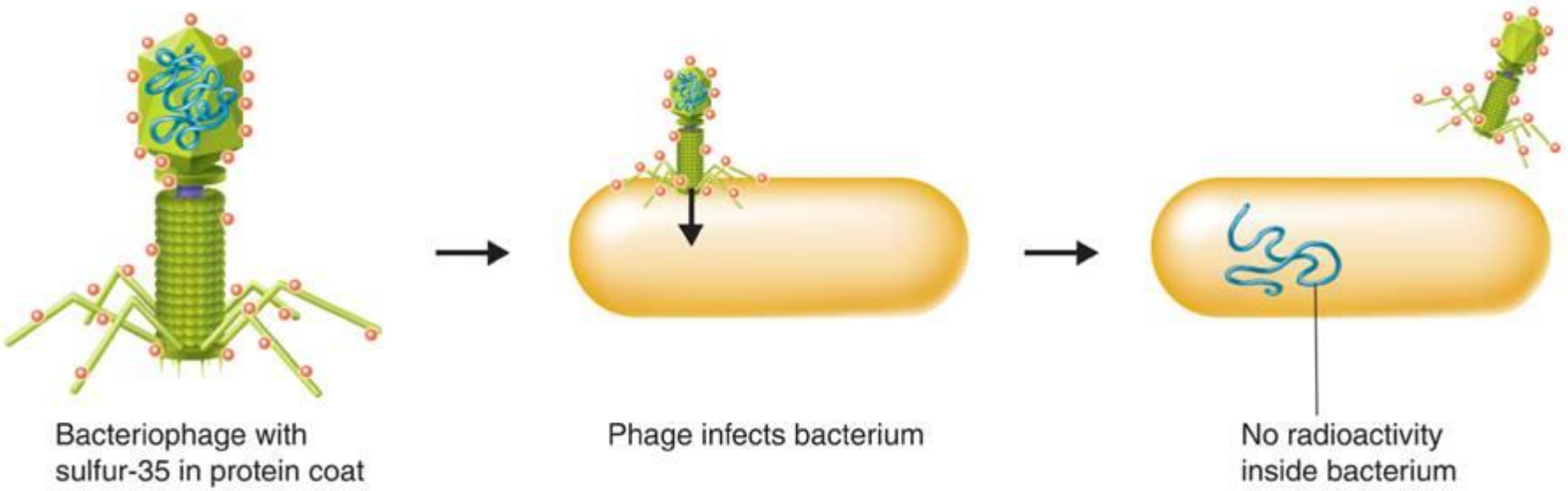
The Hershey-Chase Experiment

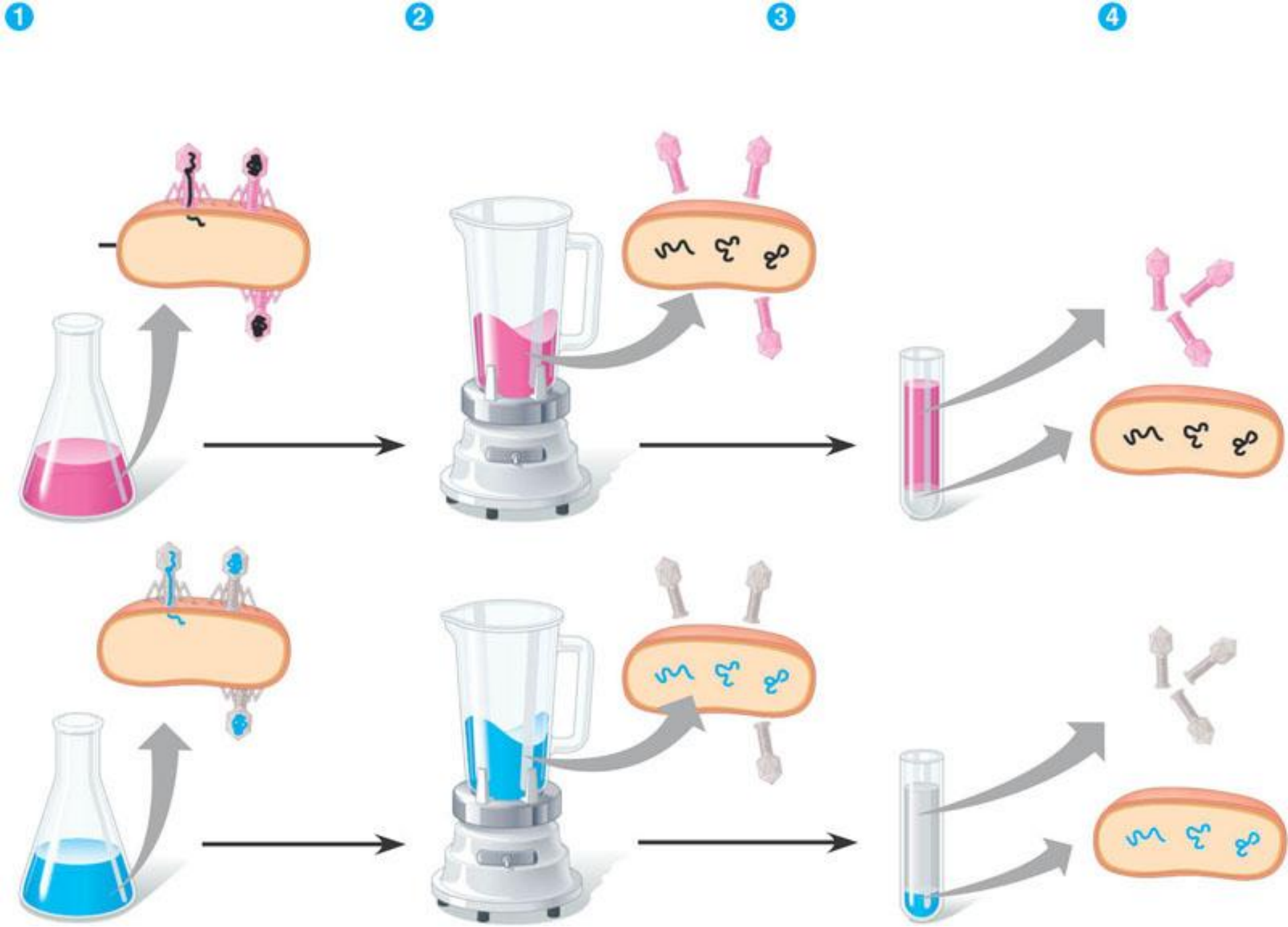
- Hershey and Chase studied viruses that infect bacteria, or bacteriophages. They performed 2 experiments.
  - Experiment 1: They tagged viral DNA with radioactive Phosphurus.



The Hershey-Chase Experiment

- Hershey and Chase studied viruses that infect bacteria, or bacteriophages. They performed 2 experiments.
  - Experiment 2: They tagged viral proteins with radioactive Sulphur.





Additional Evidence That DNA Is the Genetic Material

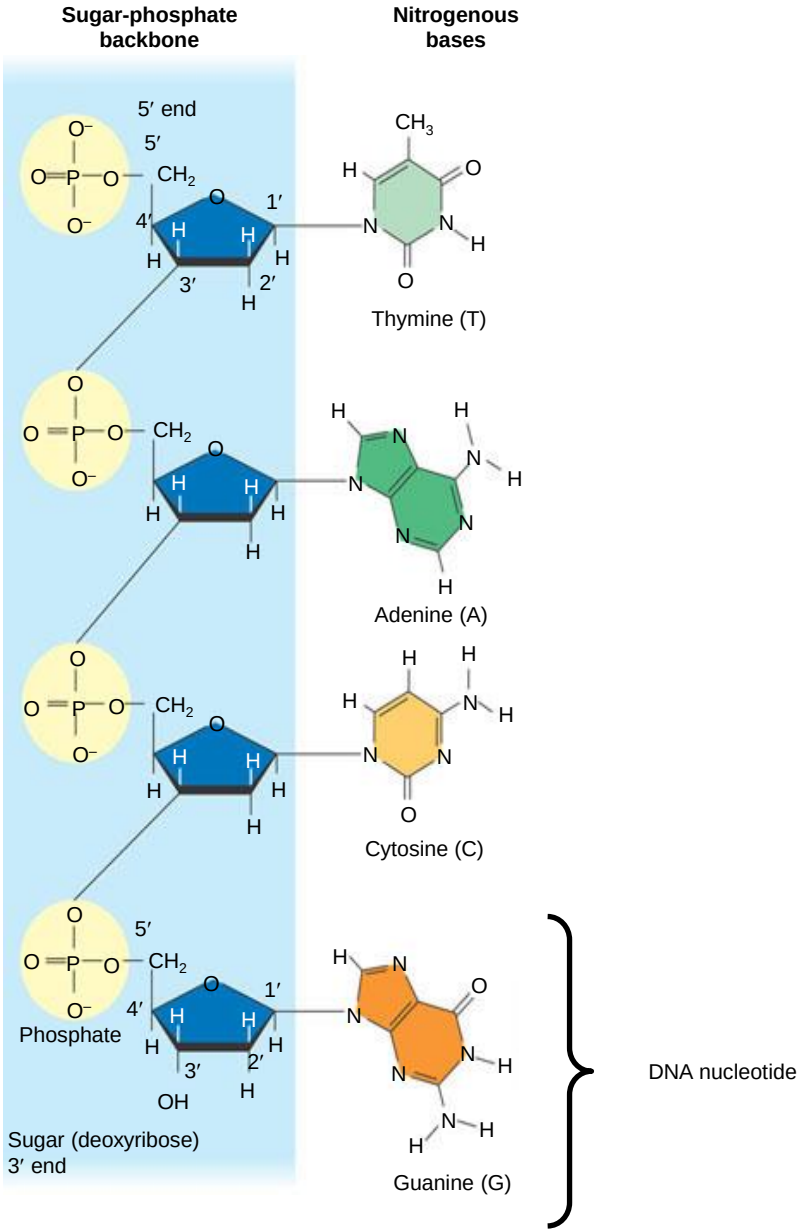
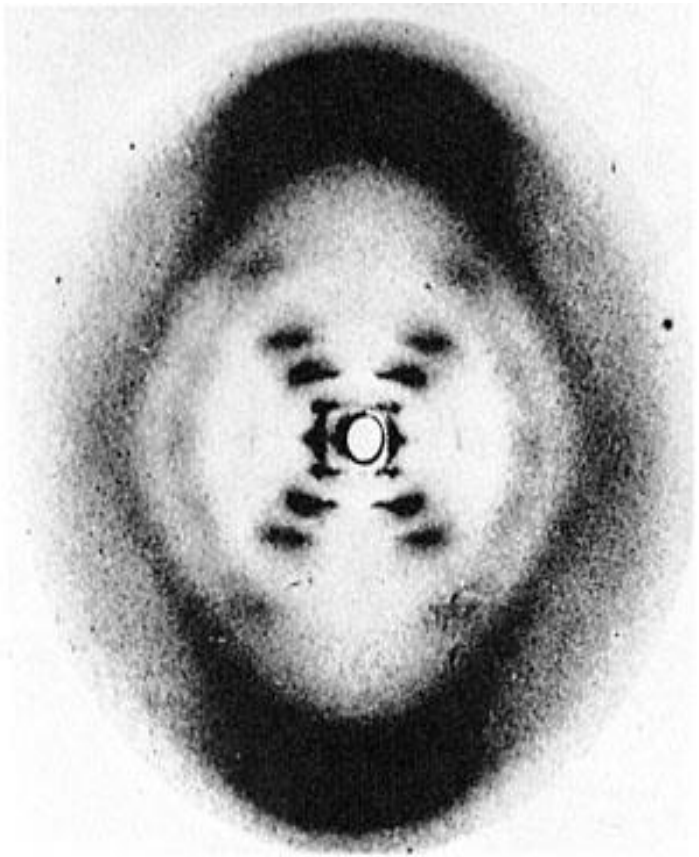


Figure 16.5

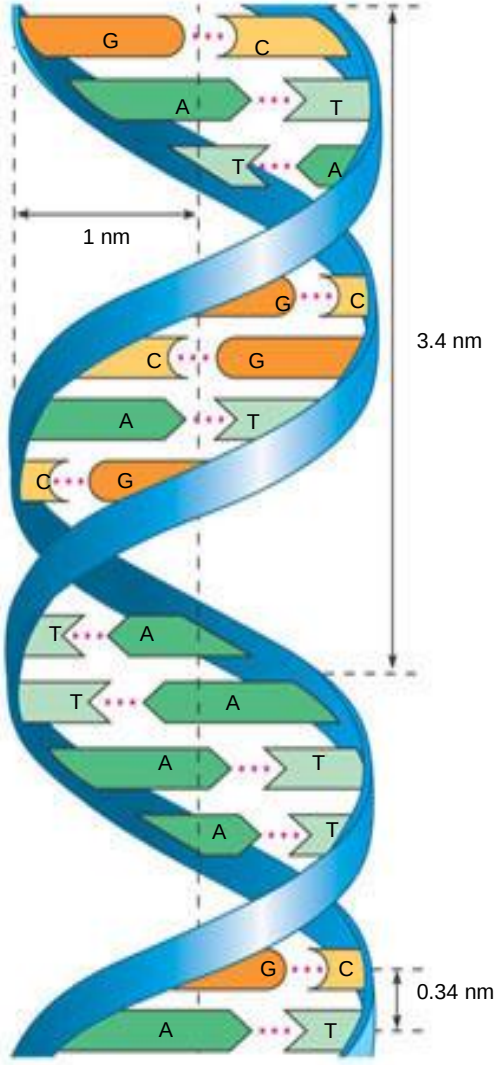
Rosalind Franklin

(a) Rosalind Franklin

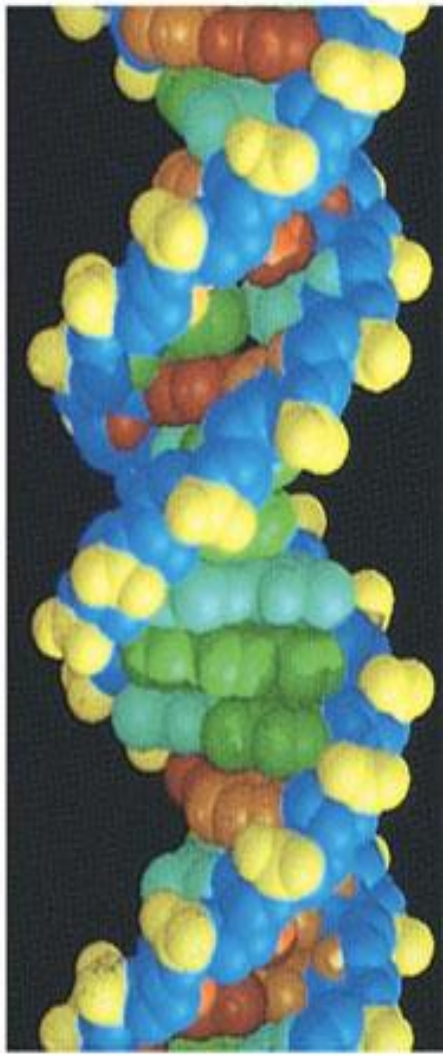


(b) Franklin's X-ray diffraction Photograph of DNA

6 a, b

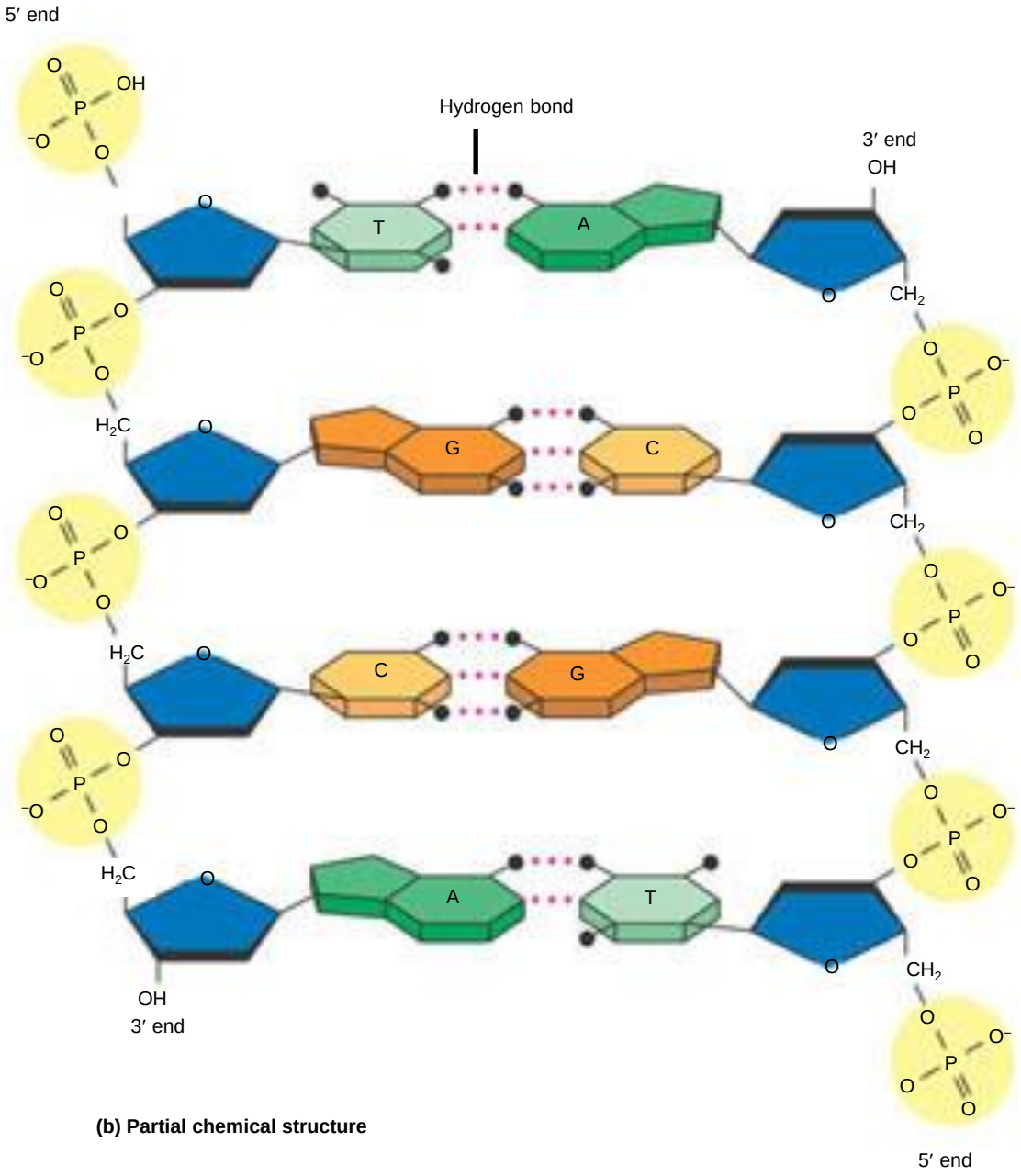


(a) Key features of DNA structure



(c) Space-filling model

Figure 16.7a, c



(b) Partial chemical structure

Figure 16.7b

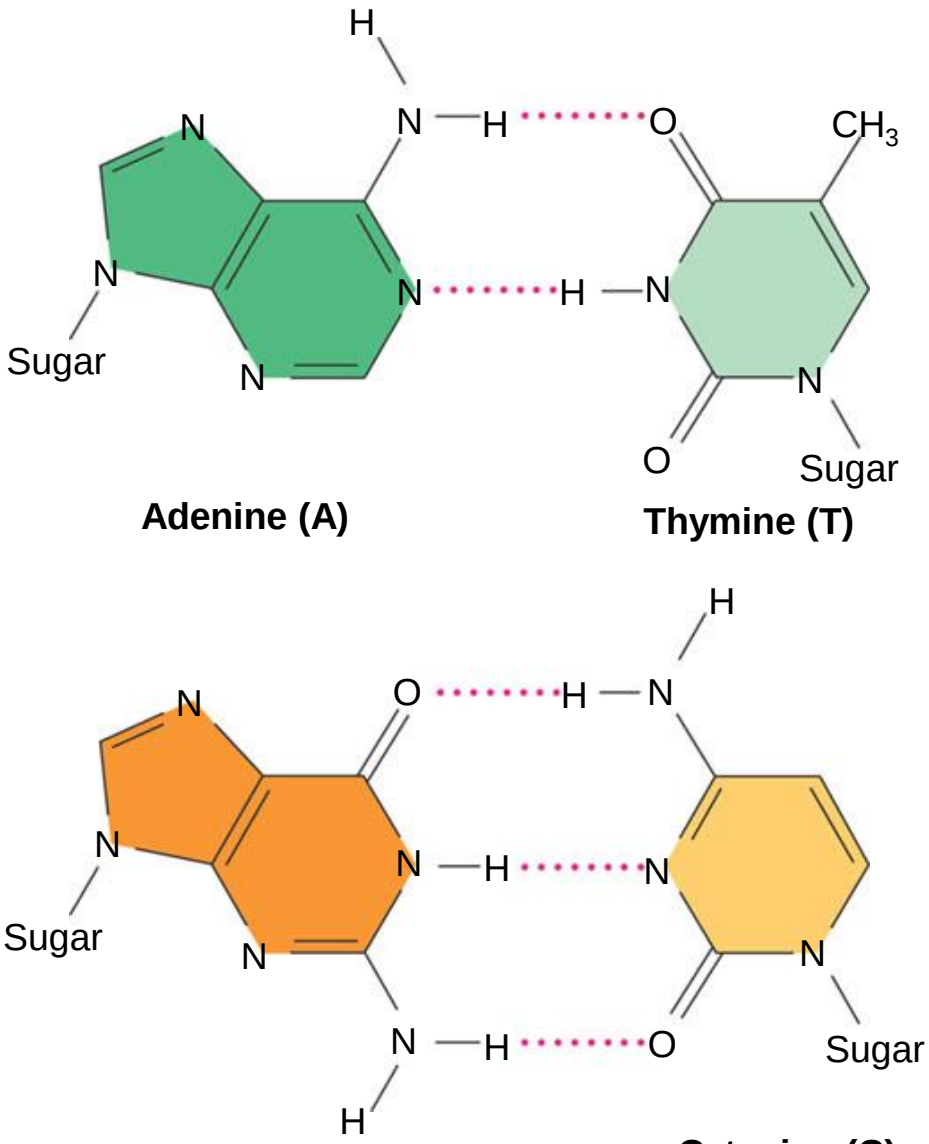
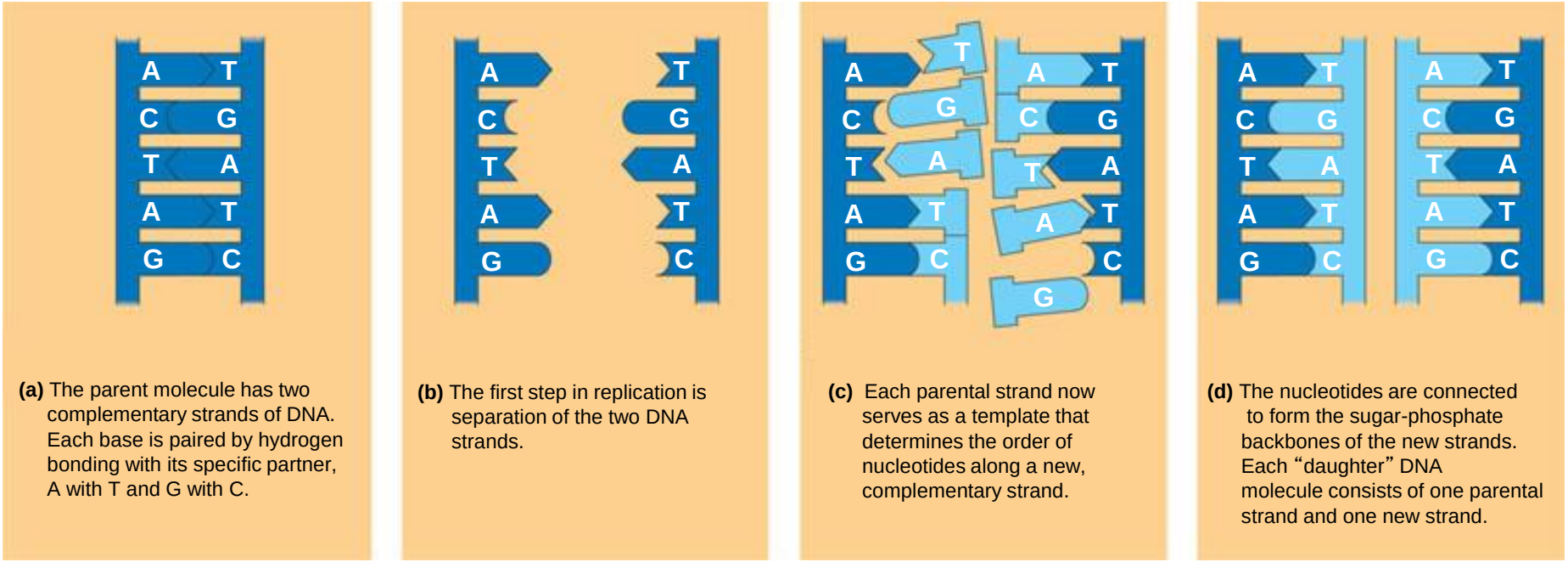


Figure 16.8

- In DNA replication
  - The parent molecule unwinds, and two new daughter strands are built based on base-pairing rules



(a) The parent molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.

(b) The first step in replication is separation of the two DNA strands.

(c) Each parental strand now serves as a template that determines the order of nucleotides along a new, complementary strand.

(d) The nucleotides are connected to form the sugar-phosphate backbones of the new strands. Each "daughter" DNA molecule consists of one parental strand and one new strand.

Figure 16.9 a–d

DNA replication is semiconservative

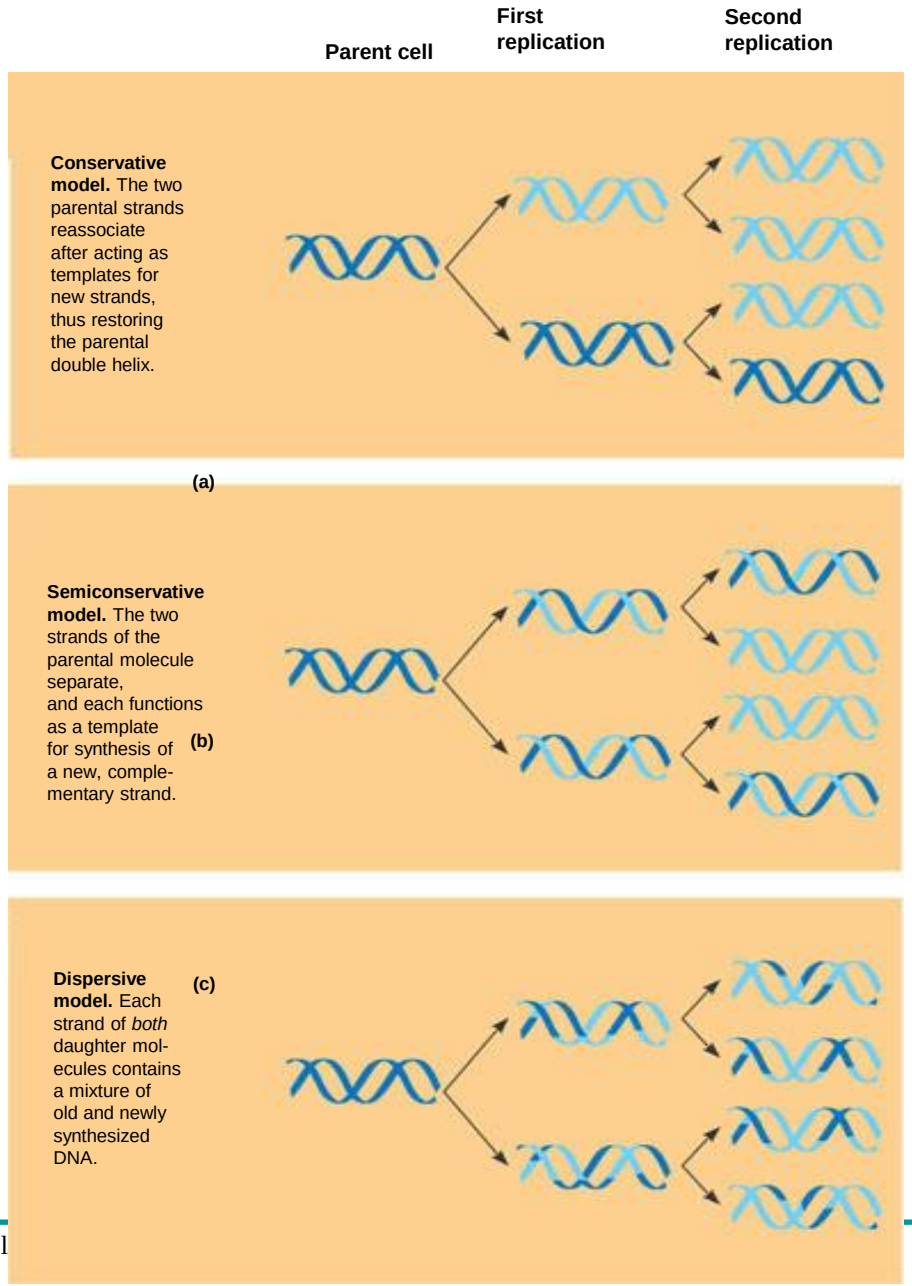
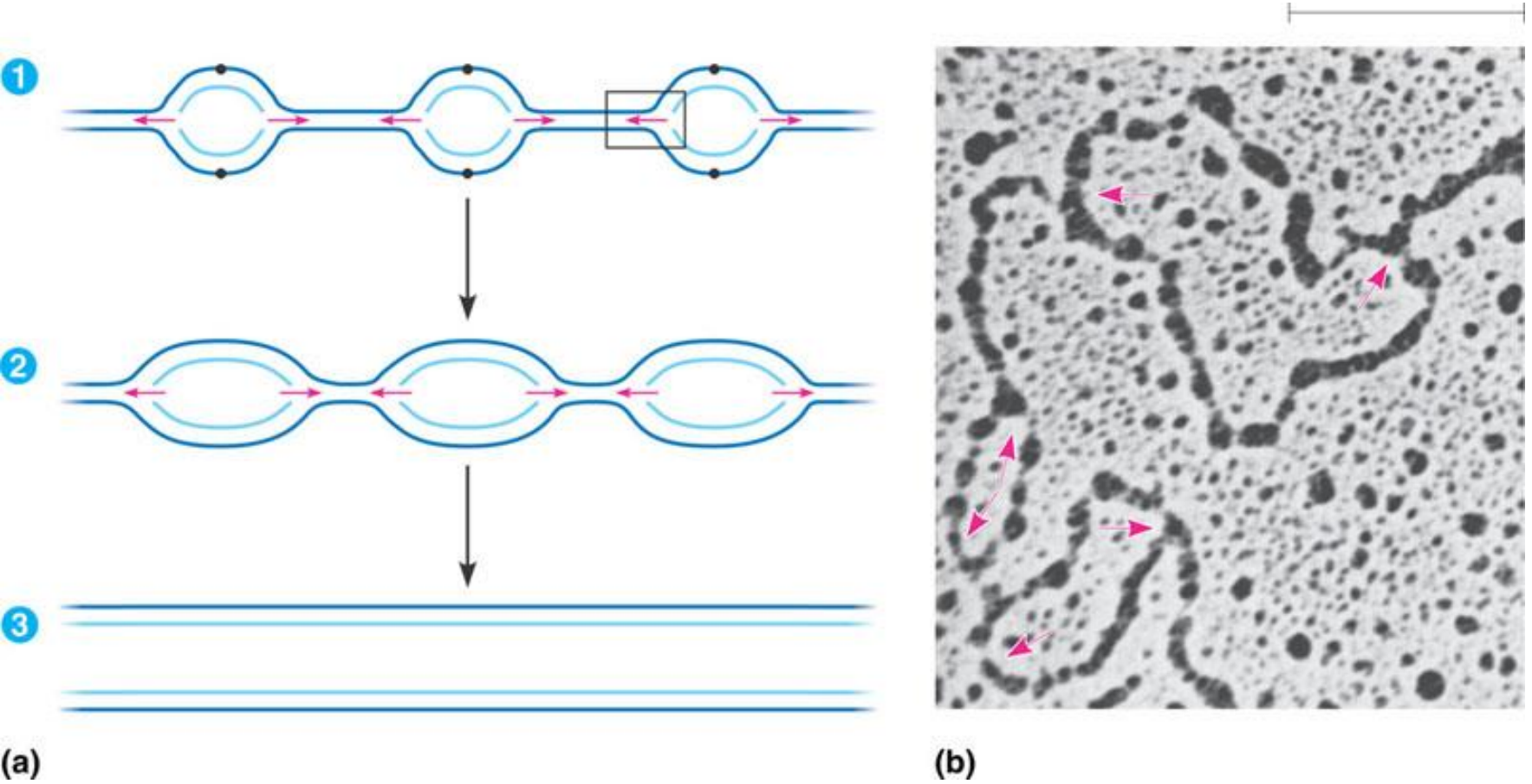


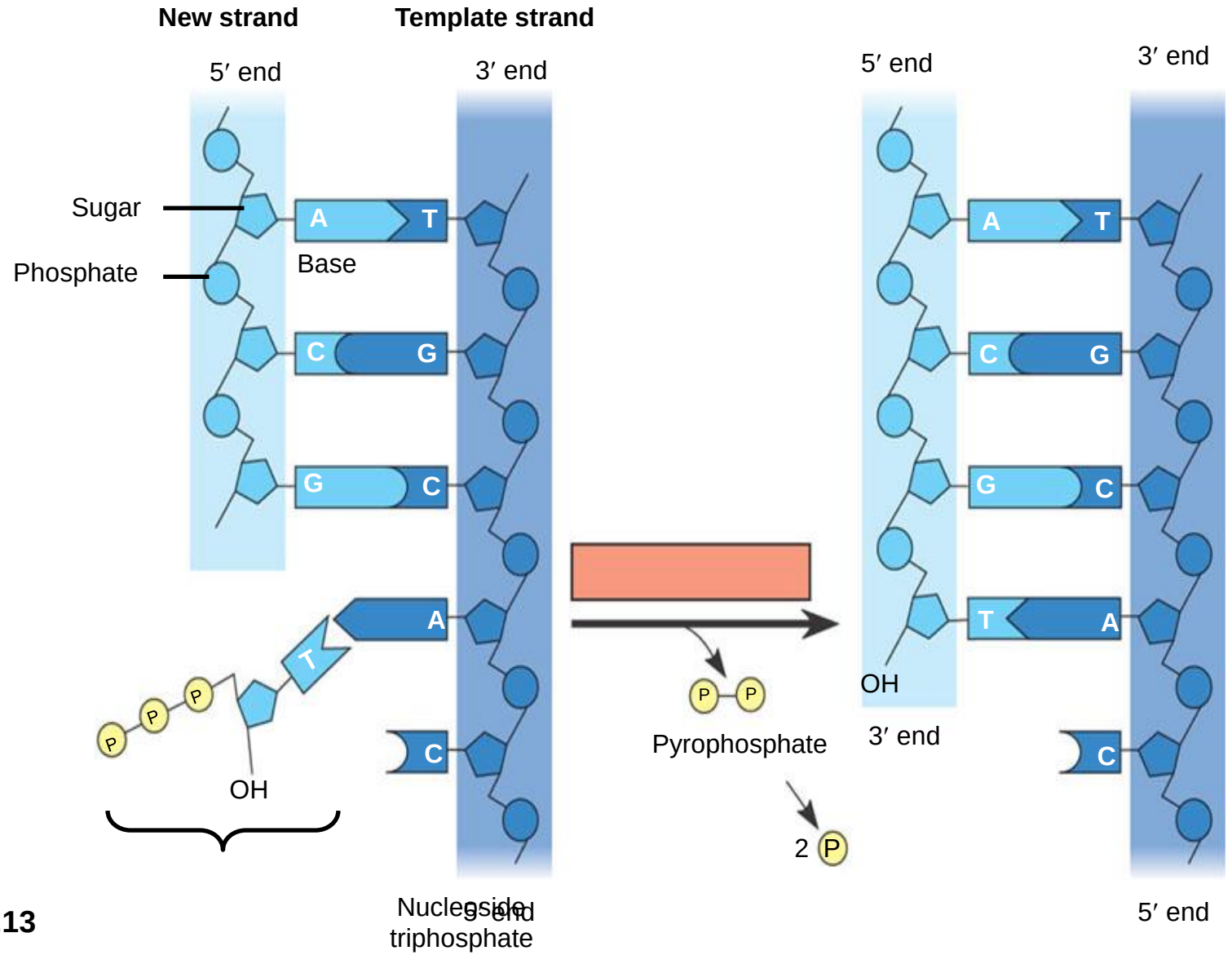
Figure 16.10 a–c

Meselson-Stahl Experiment

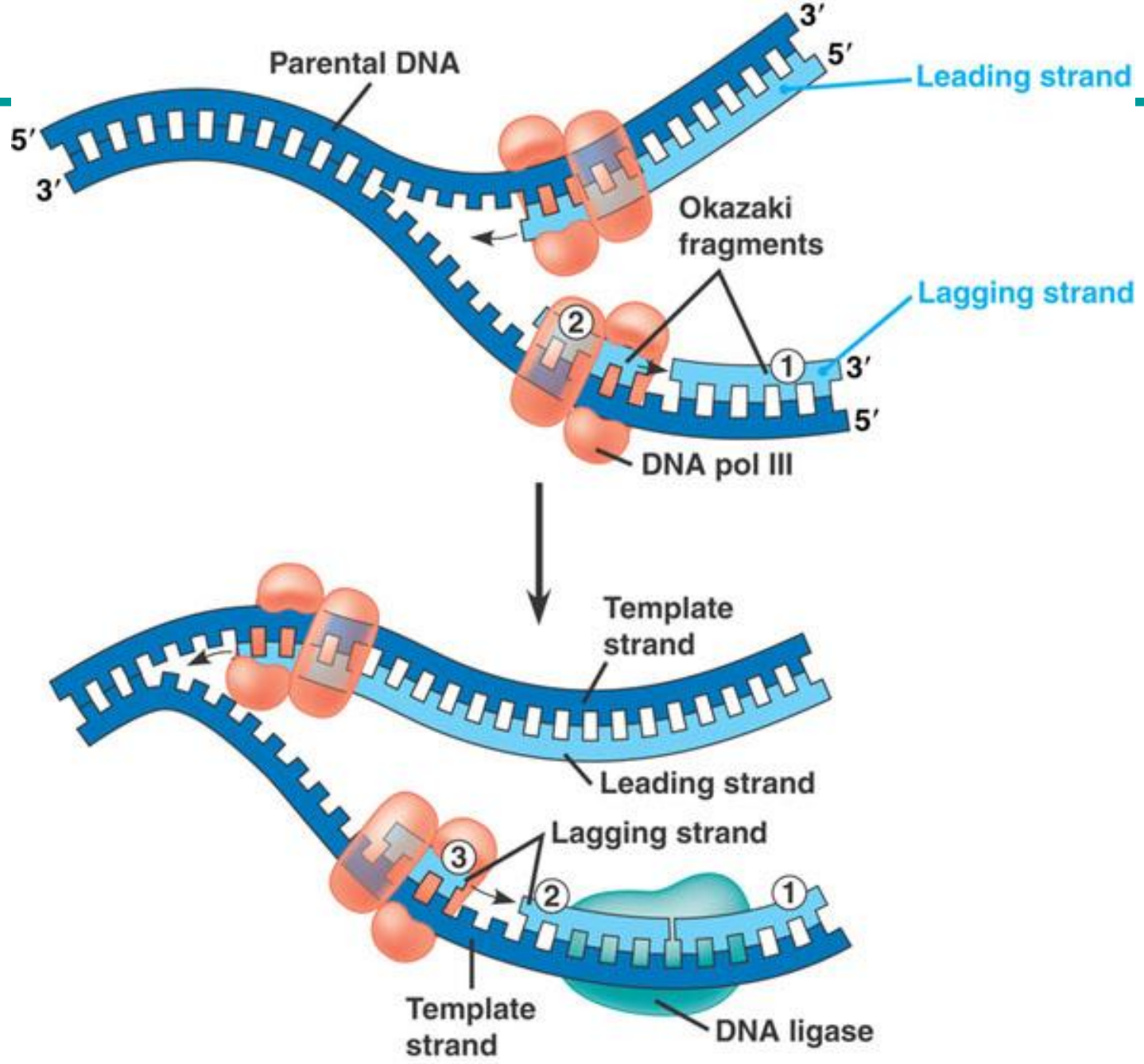
- E. coli were grown for several generations in a medium with ^{15}N.
- The DNA of the resuling cells had a higher density (was heavier).
- E. coli cells with only ^{15}N in their DNA were put back into a ^{14}N medium and were allowed to divide only once.
- DNA was then extracted from a cell and was compared to DNA from ^{14}N DNA and ^{15}N DNA.
- It was found to have exactly an intermediate density. This supported the idea of semiconservative replication.
- The DNA was intermediate in density because it had an all ^{15}N DNA strand and an all ^{14}N DNA strand. The all ^{15}N strand was one of the original strands in the original cell. The all ^{14}N strand was a newly synthesized strand.



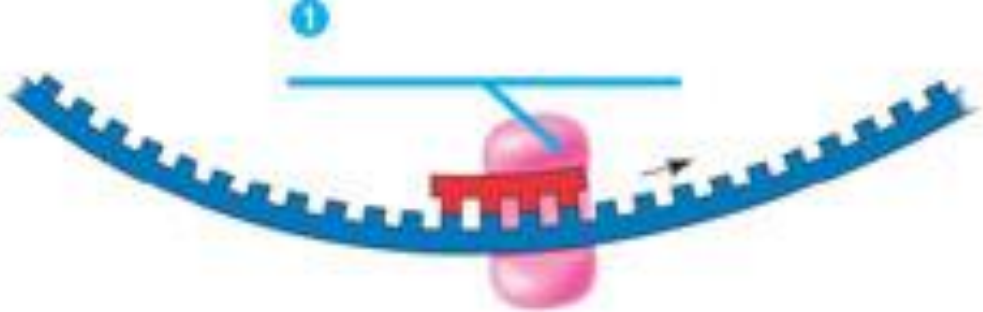
Elongating a New DNA Strand

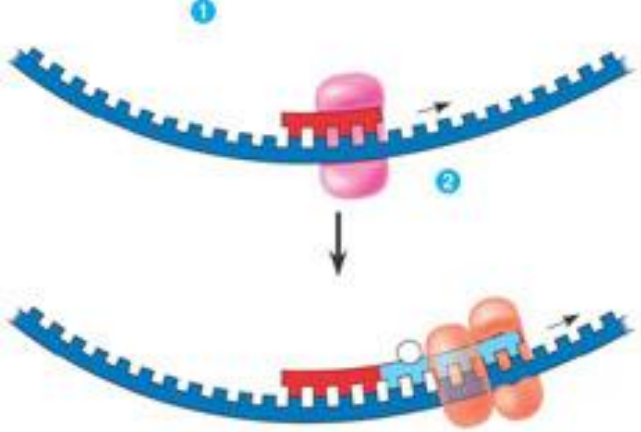


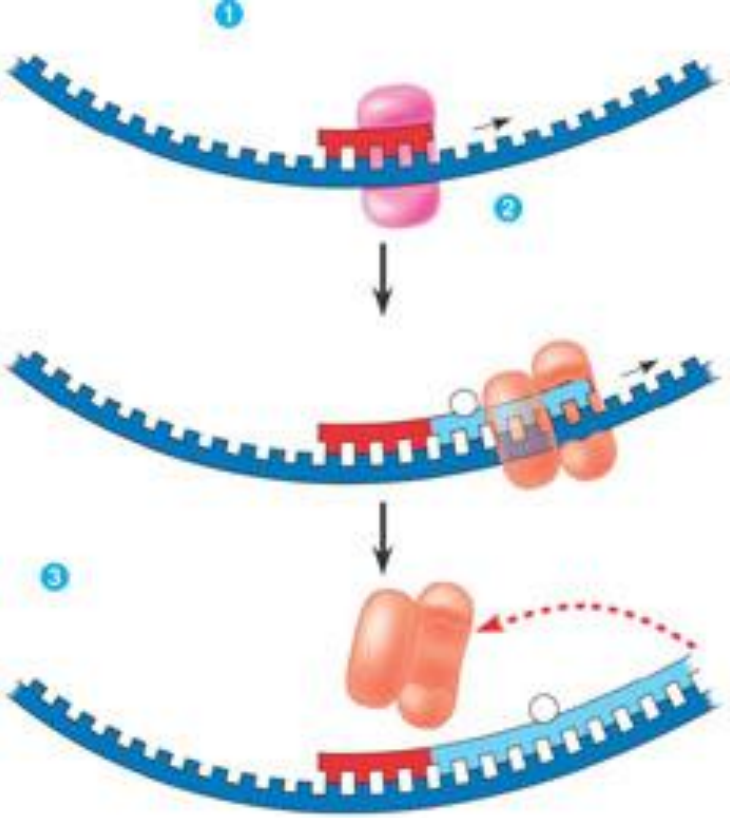
ure 16.13

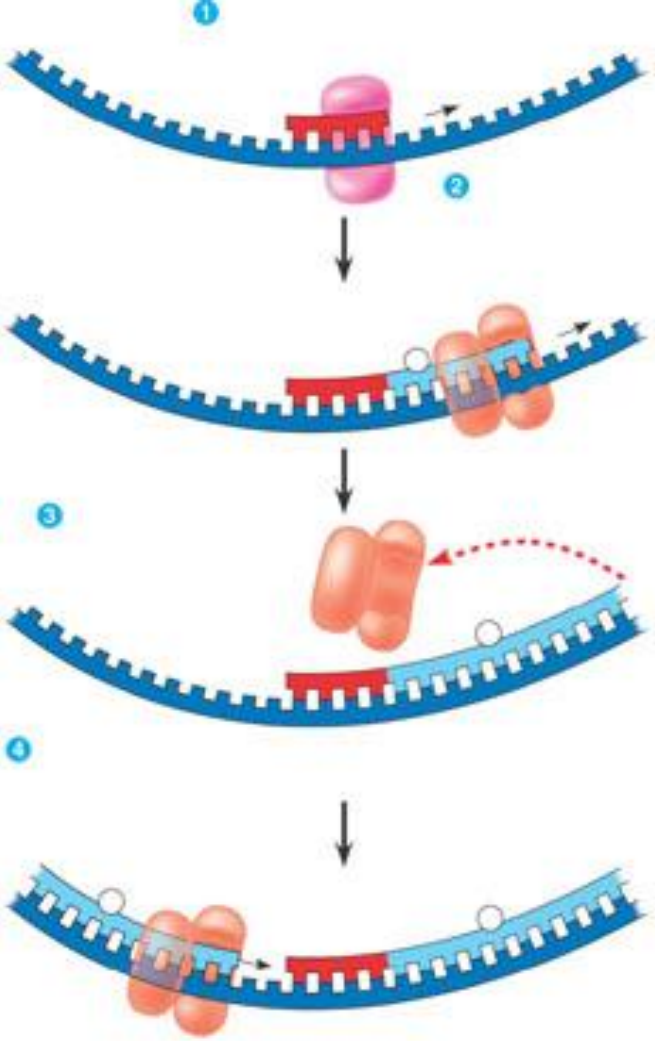


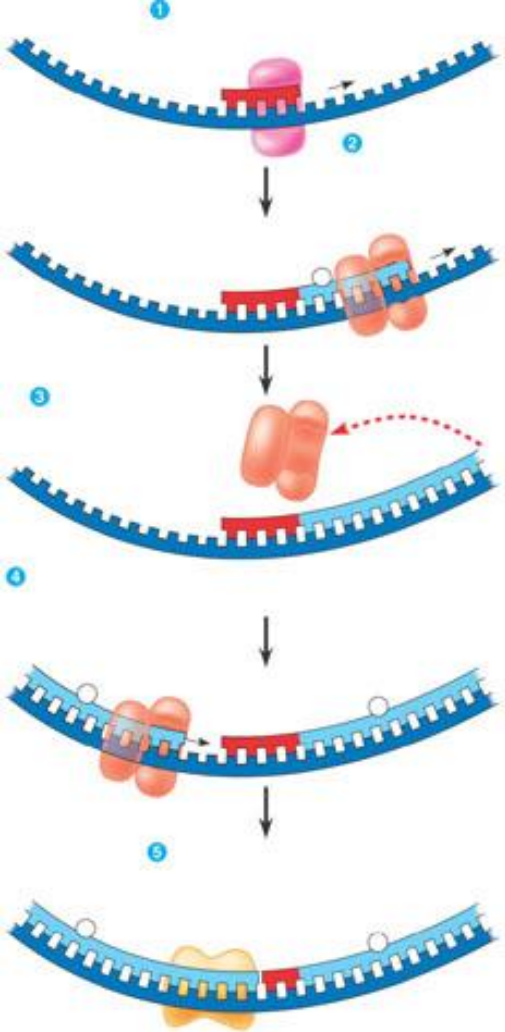
Overall direction of replication

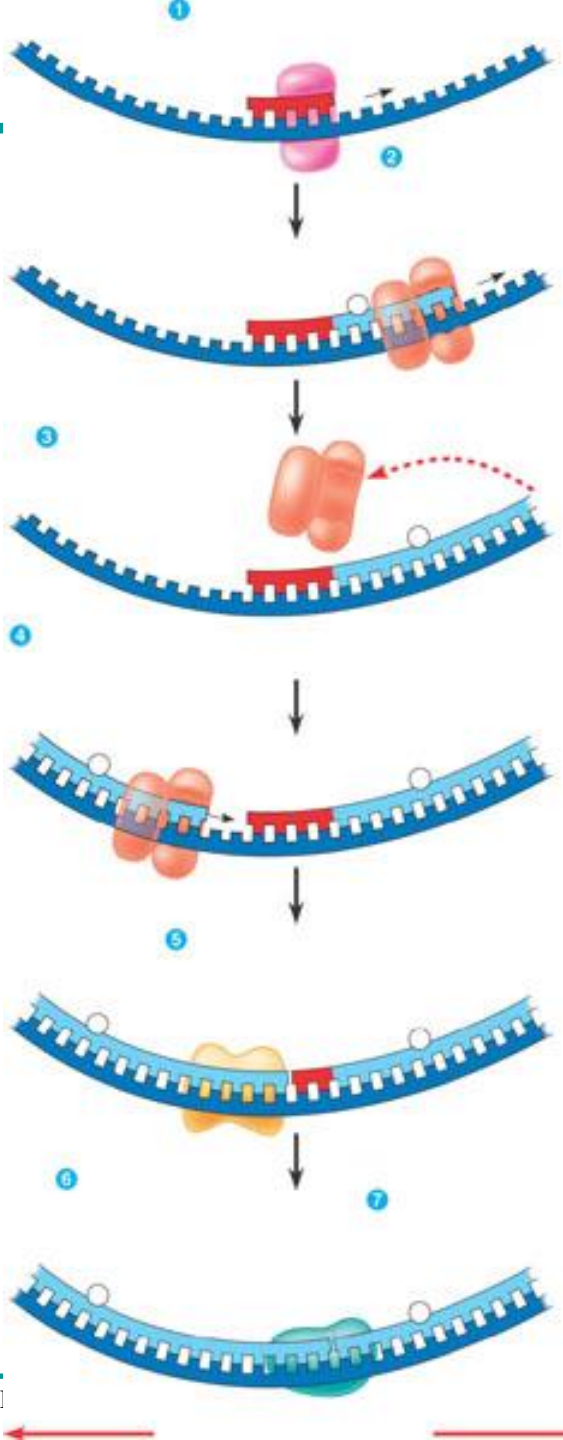


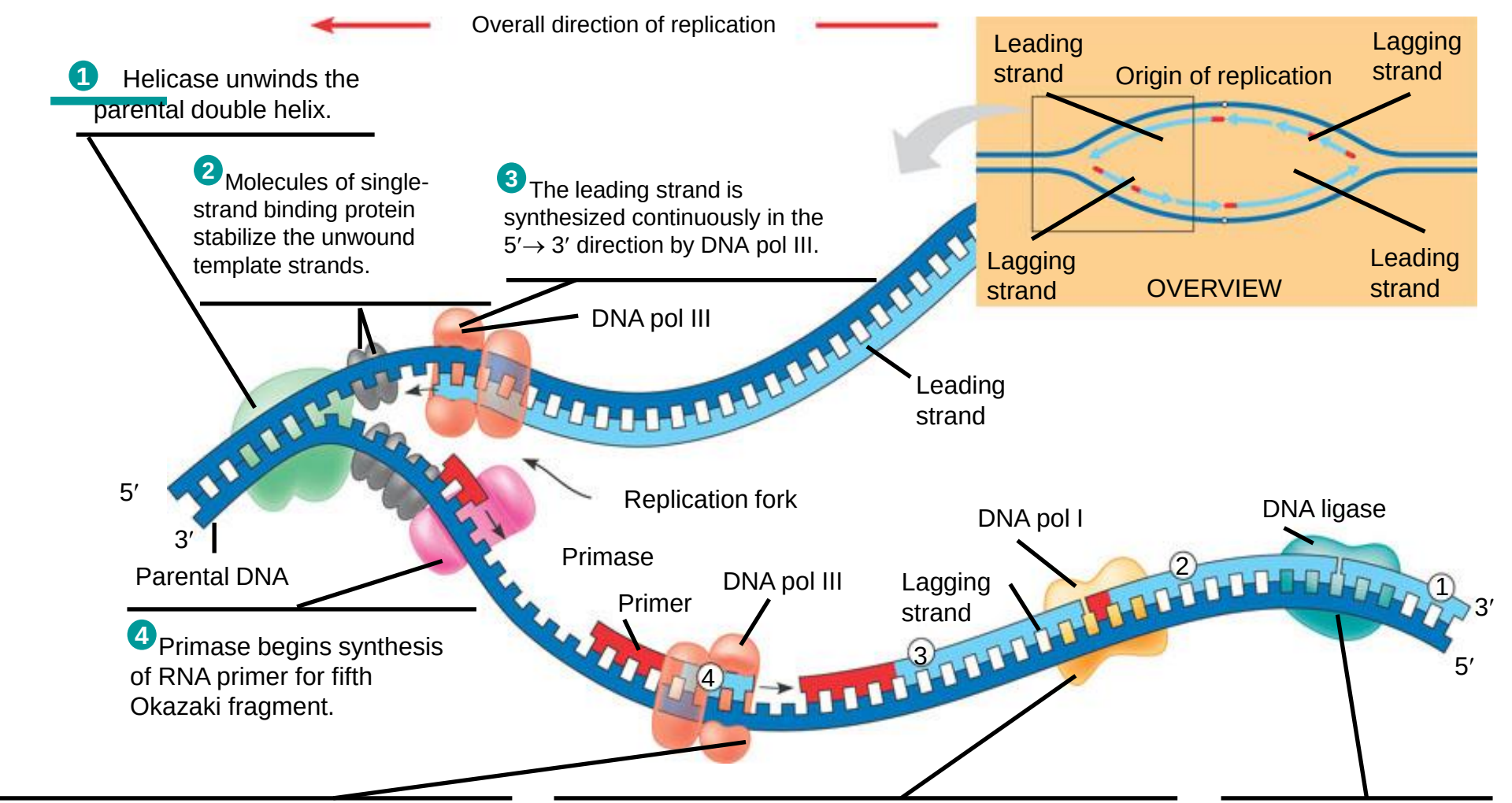












igure 16.16

Proofreading and Repairing DNA

- DNA polymerases proofread newly made DNA
  - Replacing any incorrect nucleotides
- In mismatch repair of DNA
  - Repair enzymes correct errors in base pairing

nucleotide excision repair

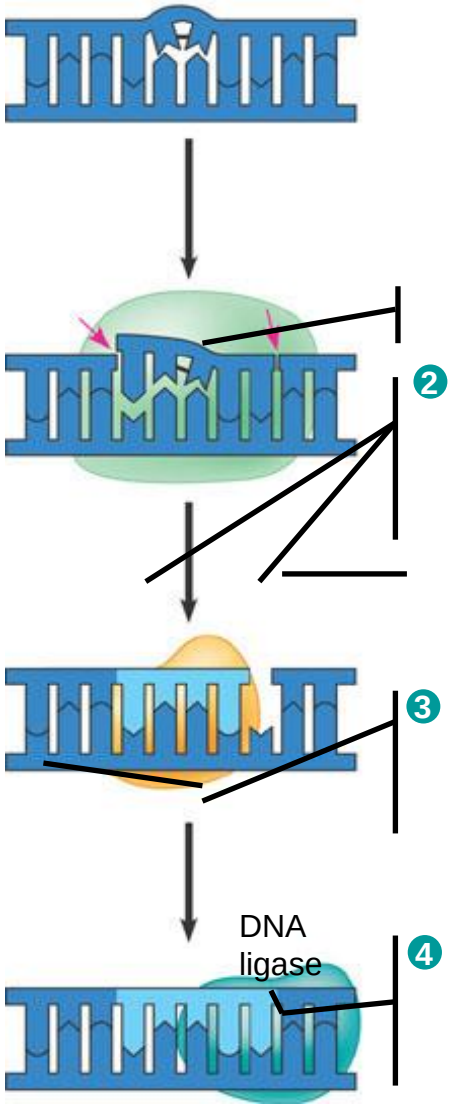


Figure 16.17

Replicating the Ends of DNA Molecules

- The ends of eukaryotic chromosomal DNA
  - Get shorter with each round of replication

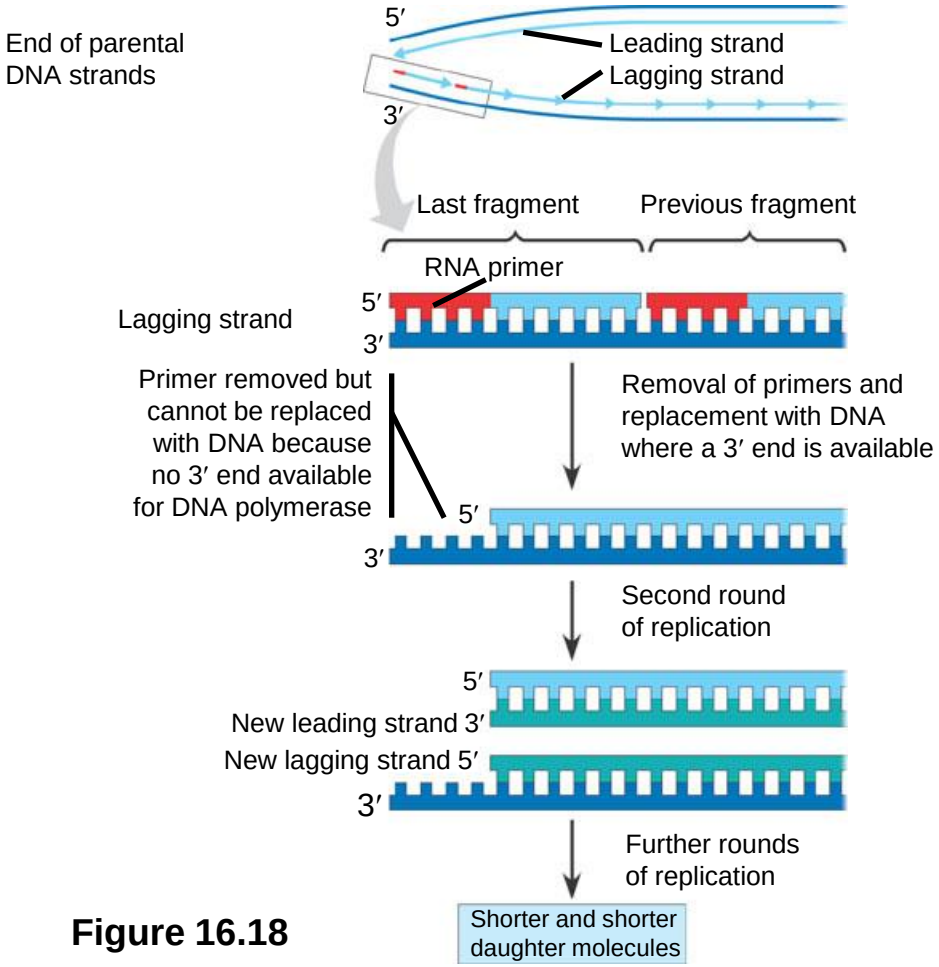


Figure 16.18

- Eukaryotic chromosomal DNA molecules
  - Have at their ends nucleotide sequences, called telomeres, that postpone the erosion of genes near the ends of DNA molecules

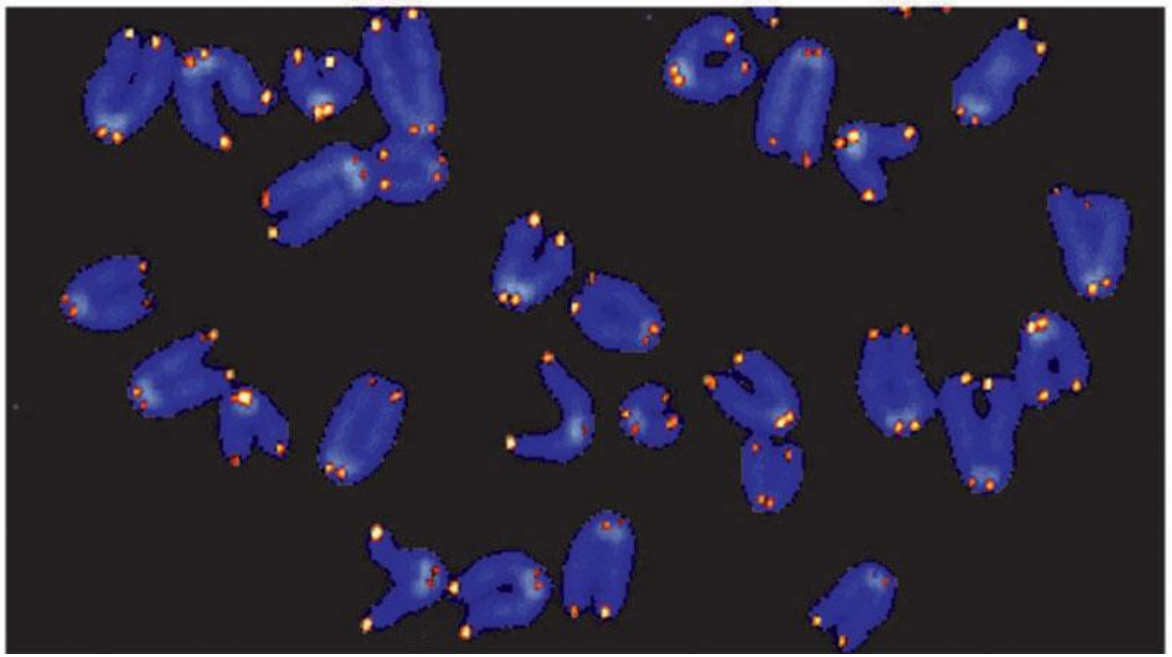


Figure 16.19

- If the chromosomes of germ cells became shorter in every cell cycle
  - Essential genes would eventually be missing from the gametes they produce
- An enzyme called telomerase
  - Catalyzes the lengthening of telomeres in germ cells