

DNA Replication Mechanism

Semiconservative Replication

- Each strand serves as template
- Two identical daughter DNA molecules
- Proven by Meselson-Stahl experiment
- Ensures genetic continuity

DNA Polymerase III

- Main replication enzyme in prokaryotes
- Adds nucleotides 5' → 3'
- Requires RNA primer
- Processivity: ~500,000 bp

Leading vs Lagging Strand

- Leading: continuous synthesis
- Lagging: discontinuous synthesis
- Okazaki fragments (~1000-2000 nt)
- DNA ligase joins fragments

✓ Proofreading

- 3' → 5' exonuclease activity
- Error rate: ~1 in 10⁷ bases
- Removes mismatched nucleotides
- Ensures high fidelity

