2. Bacterial DNA replication

起始阶段
- 辨识复制起始点
- 高级结构解除（ DnaB ）
- DnaG合成RNA引物

延伸阶段
- 复制叉的移动（ DnaB, DNA gyrase ）
- DNA Pol Ⅲ沿模板滑动
- 催化3’, 5’-磷酸二酯键形成
- DNA Pol Ⅰ切除RNA引物，填补空缺
- 连接酶连接缺口

终止阶段
- 复制叉移动到终止位点停止复制
- 子链分离（ Topo Ⅳ ）

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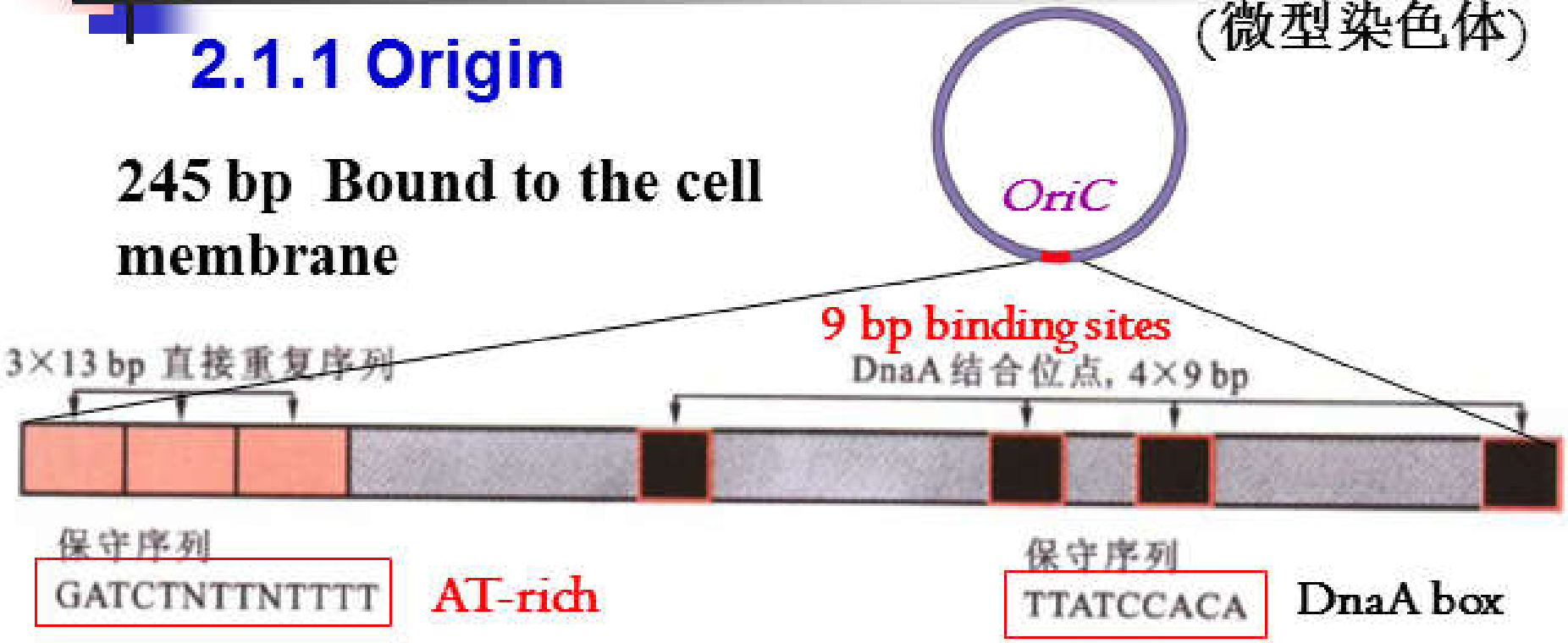
2.1 Initiation

oriC-minichromosome

(微型染色体)

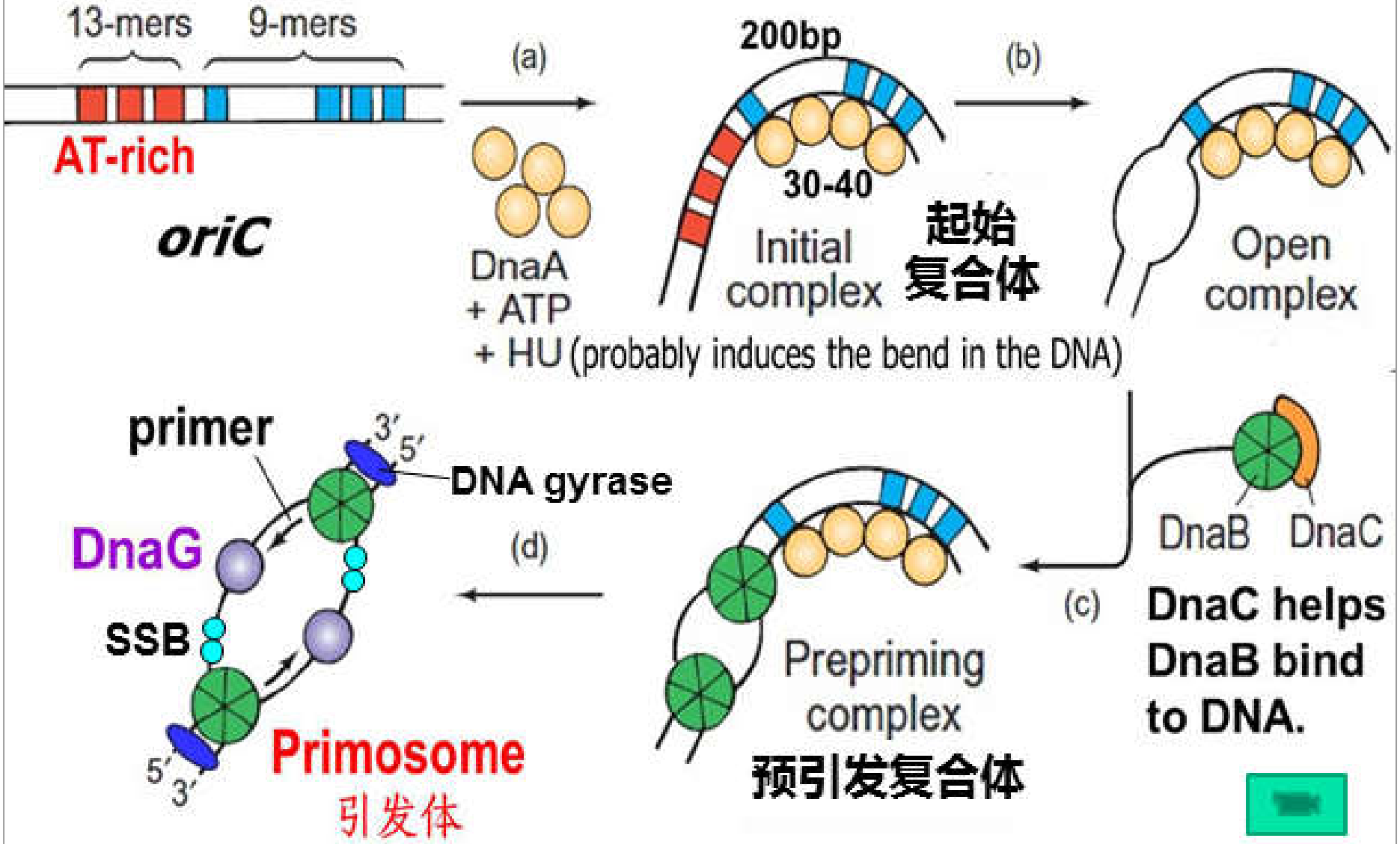
2.1.1 Origin

245 bp Bound to the cell membrane



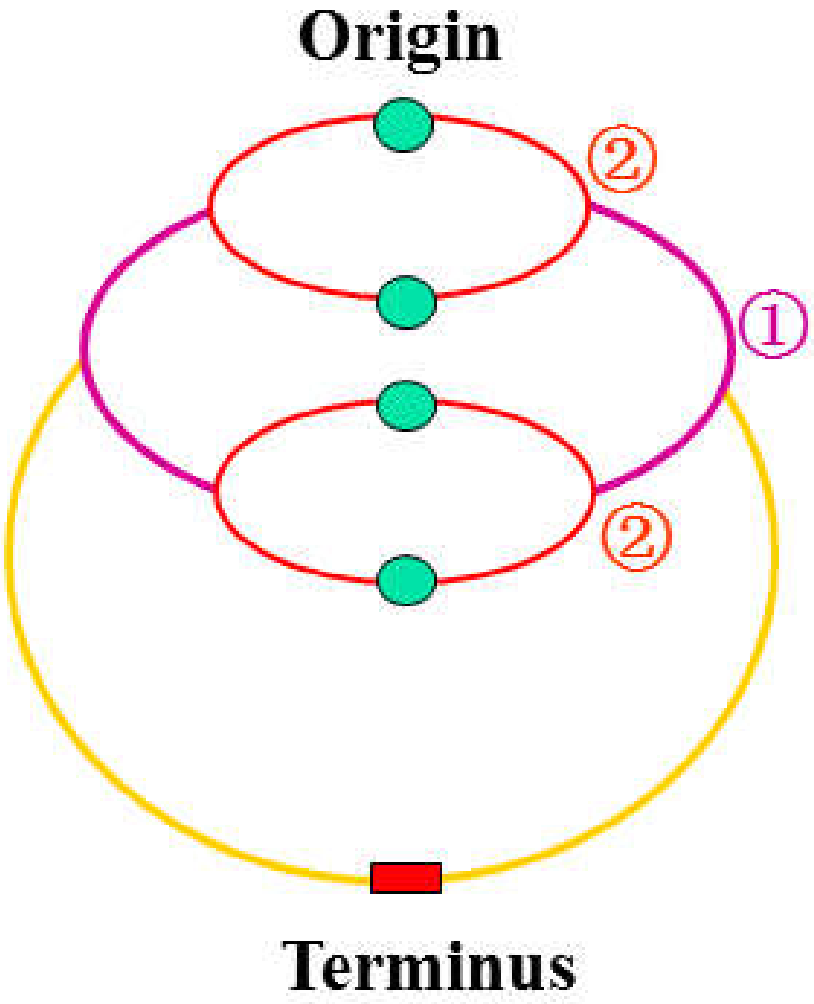
- **DnaA is the initiator（起始因子） protein which appears to facilitate the binding of DnaB to the origin.**

2.1.2 Priming at *oriC*



2.1.3 Initiation feature in prokaryotes

- At high cellular growth rates, the replication of the DNA can reinitiate（重新启动）a second round at the two new origins before the first round is completed.



2.2 Elongation

2.2.1 The β clamp (钳、夹)

- The core on the leading strand is high processive (进行性的) because β clamp keeps it on the DNA.
- The β clamp associated with the core on the lagging strand dissociates at the end of each Okazaki fragment and reassembles for the next fragment.

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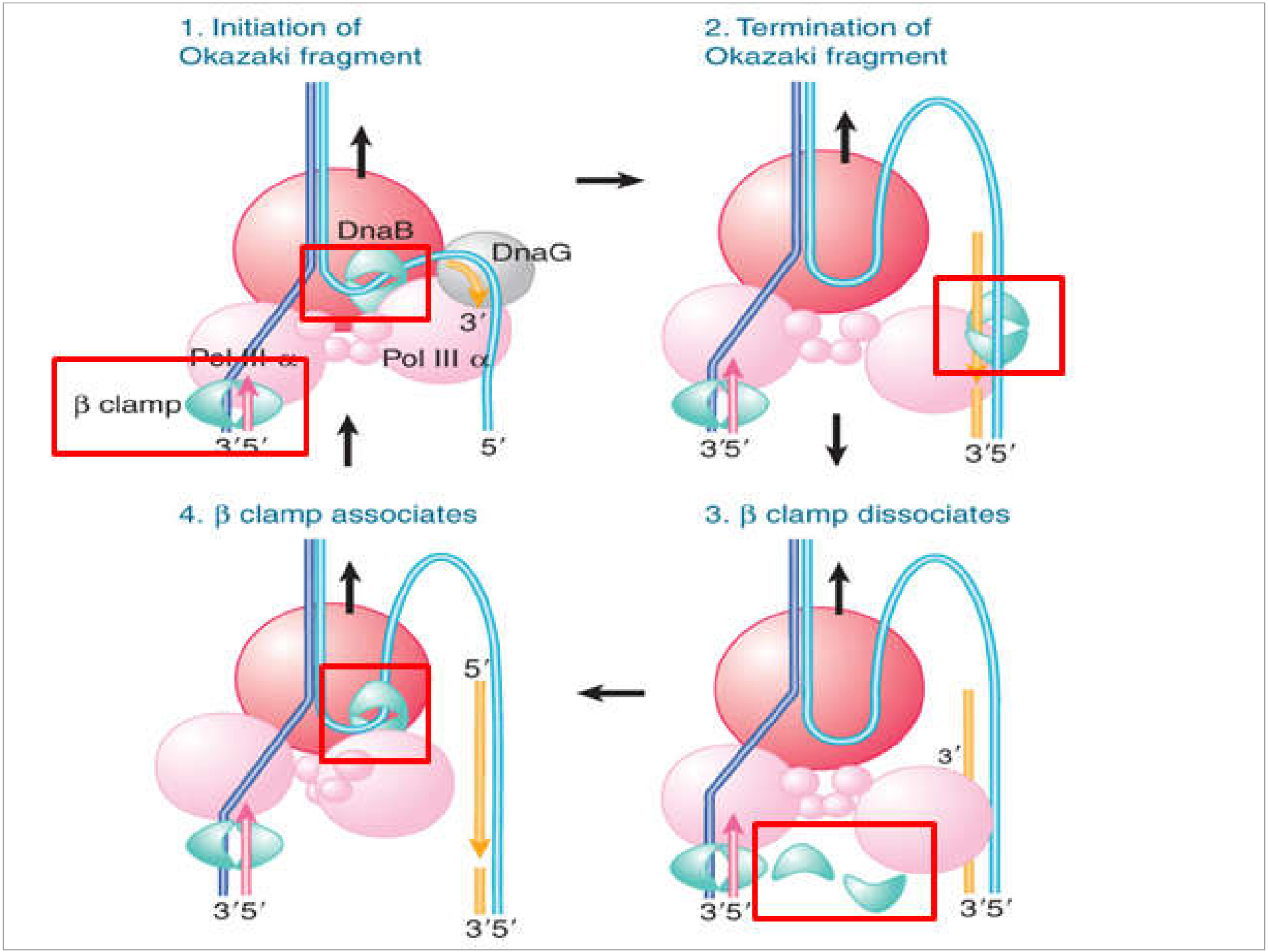
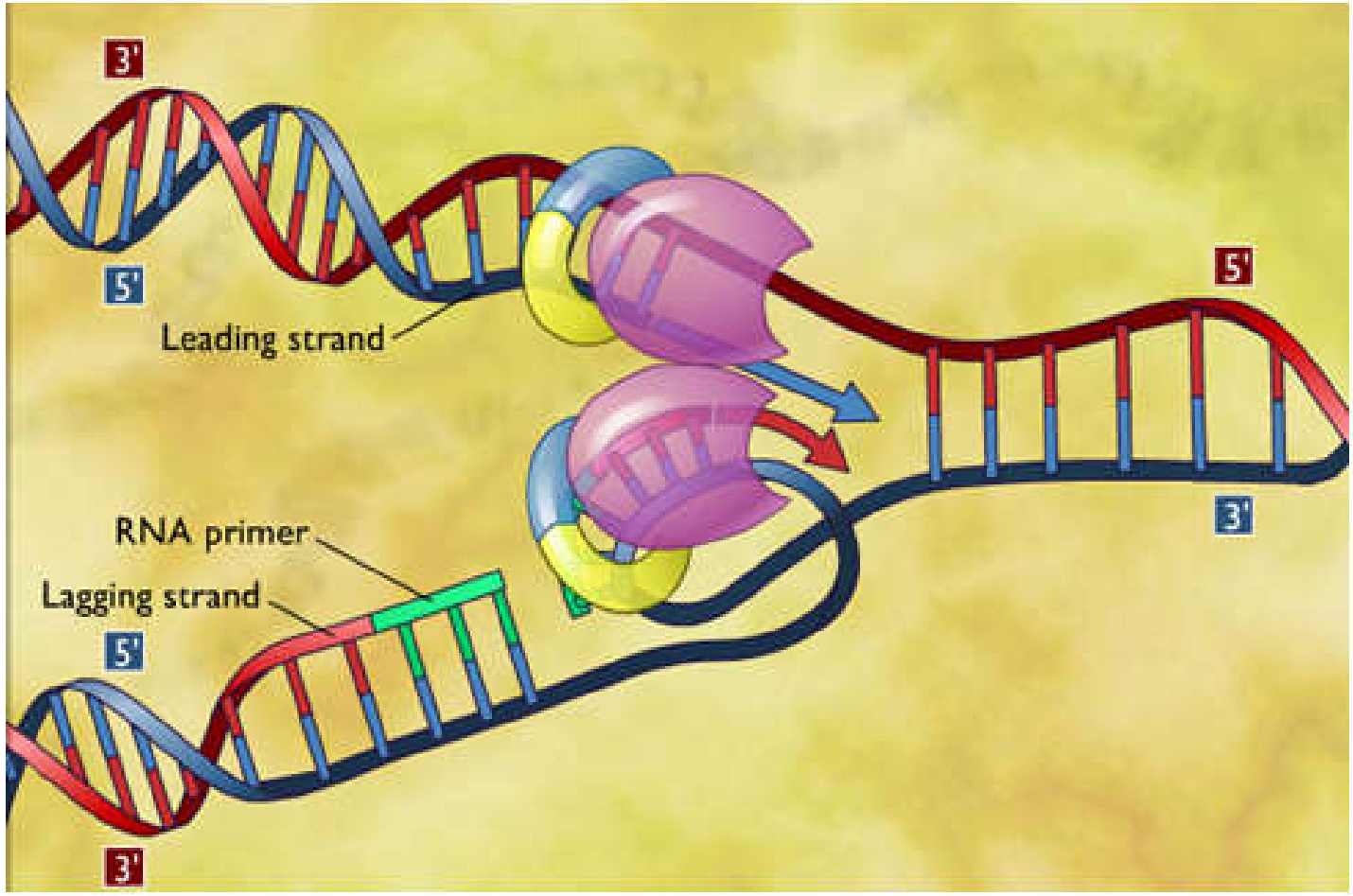
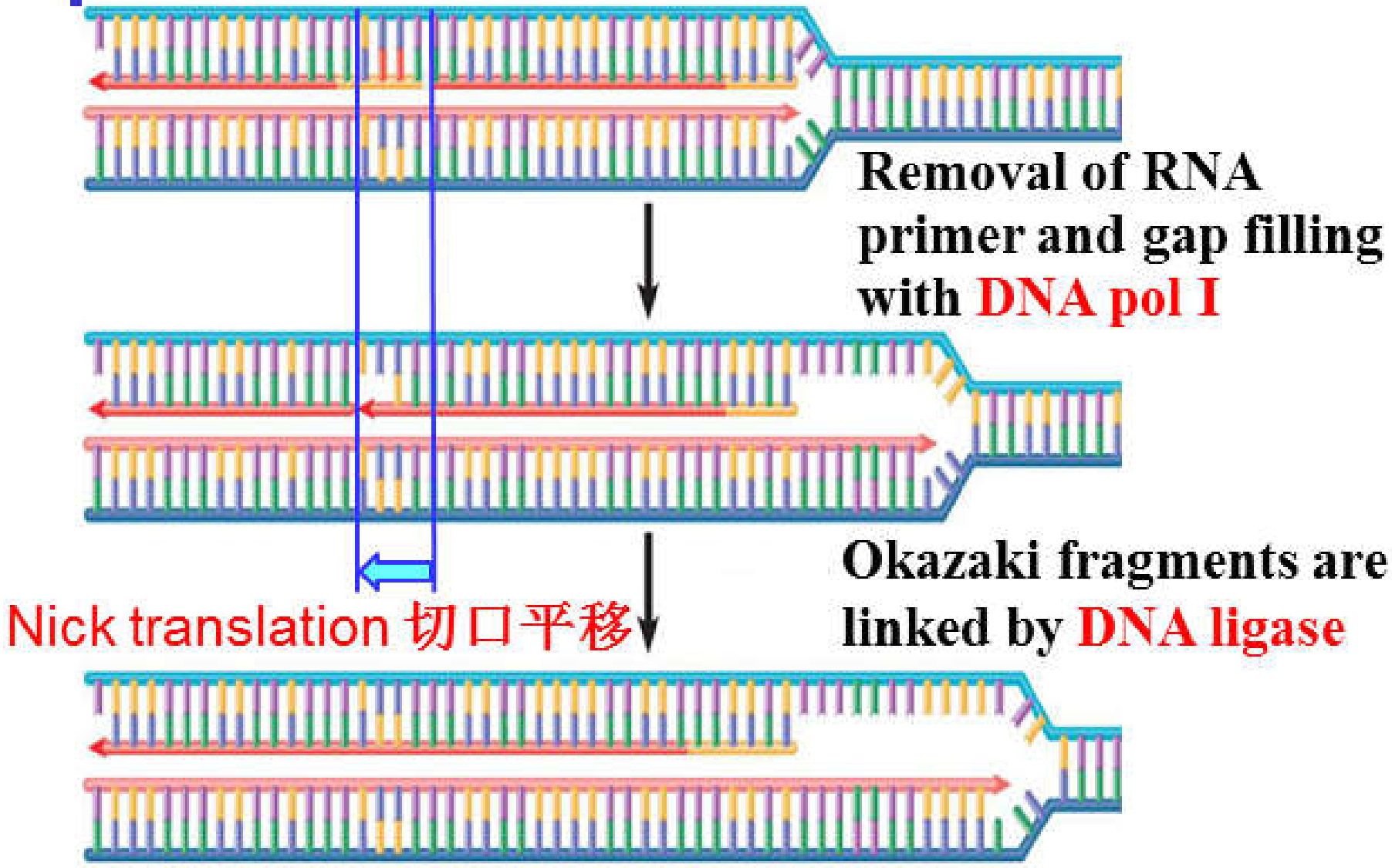
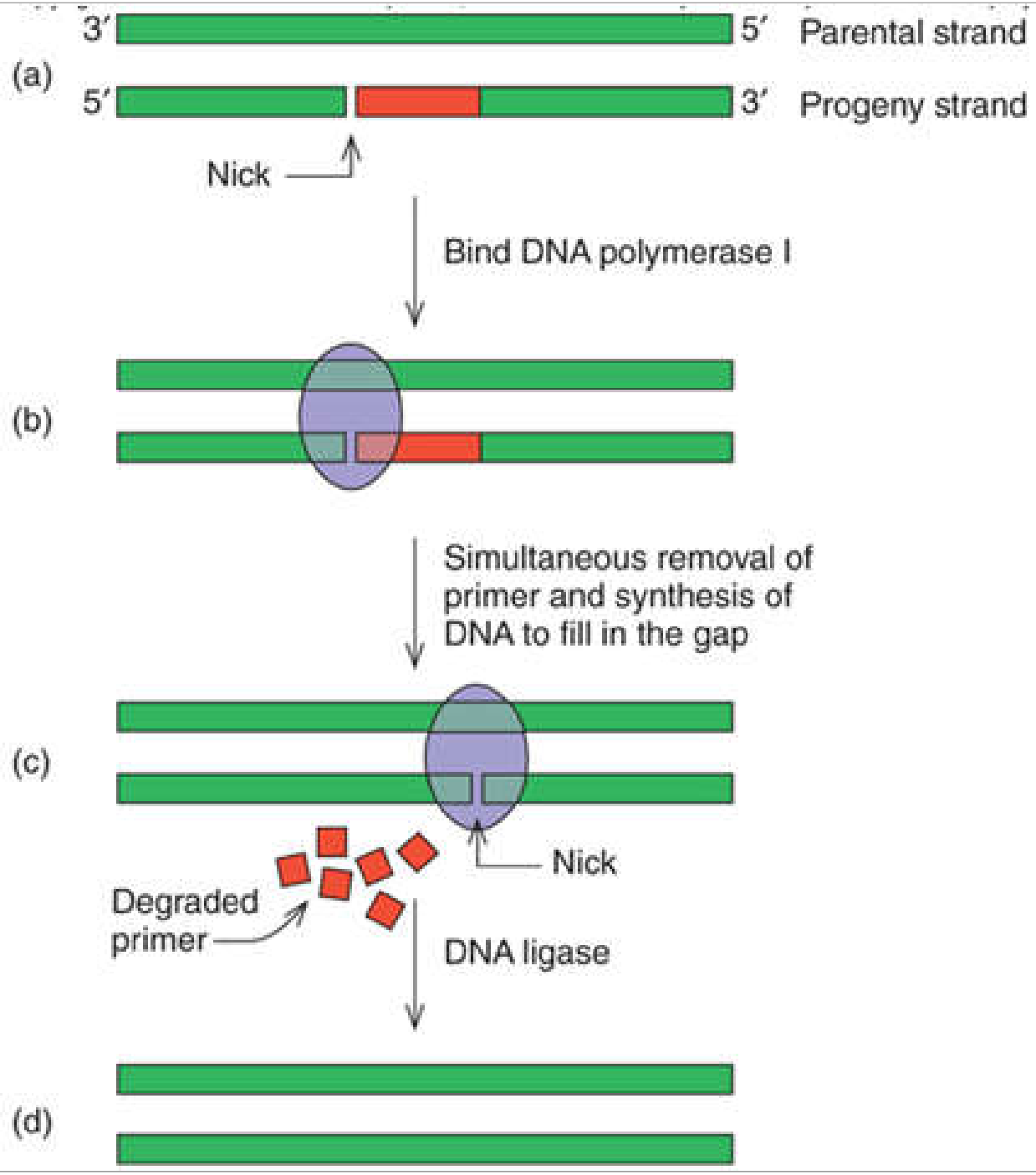

1. Initiation of
Okazaki fragment
DnaB
DnaG
3′
Pol III α
β clamp
3′5′
5′
2. Termination of
Okazaki fragment
3′5′
3′5′
3. β clamp dissociates
3′
3′5′
3′5′
4. β clamp associates
5′
3′5′
3′5′



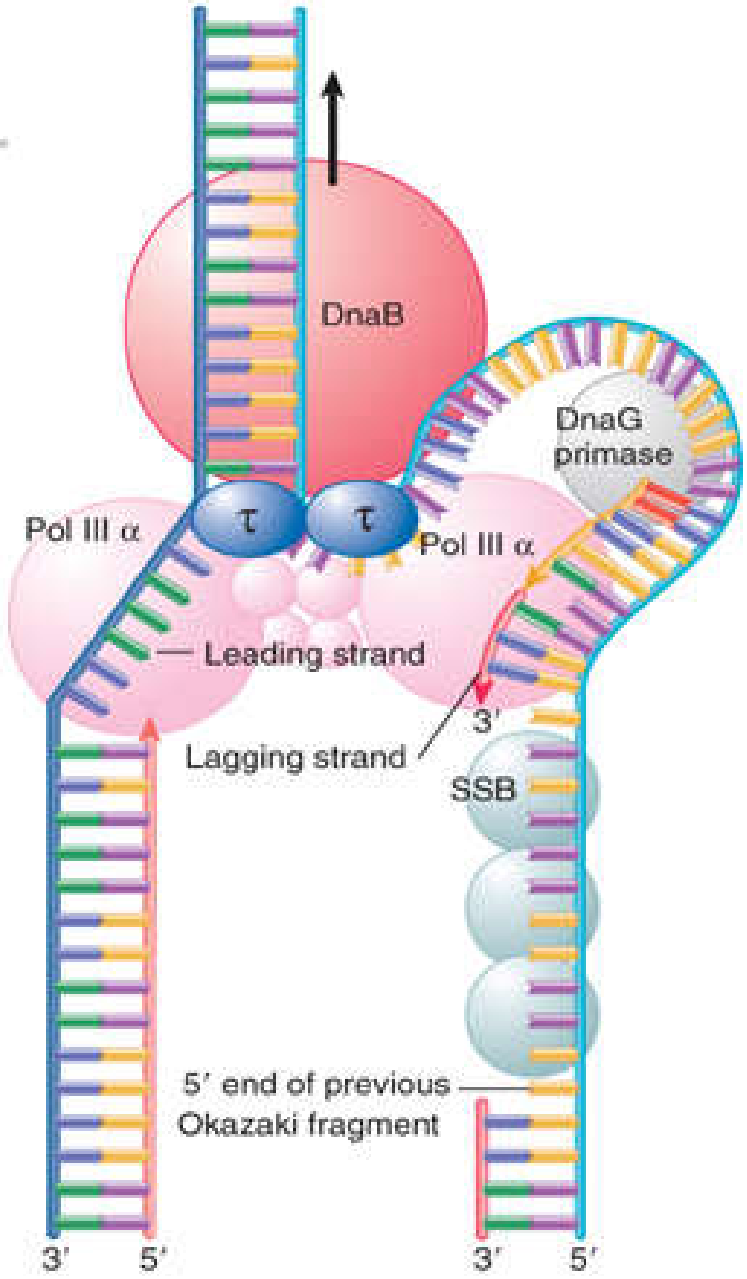
- To allow simultaneous replication of the leading and lagging strands by dimeric DNA pol III, the DNA of **the lagging strand has to be folded.**

2.2.2 Primer removal and ligation



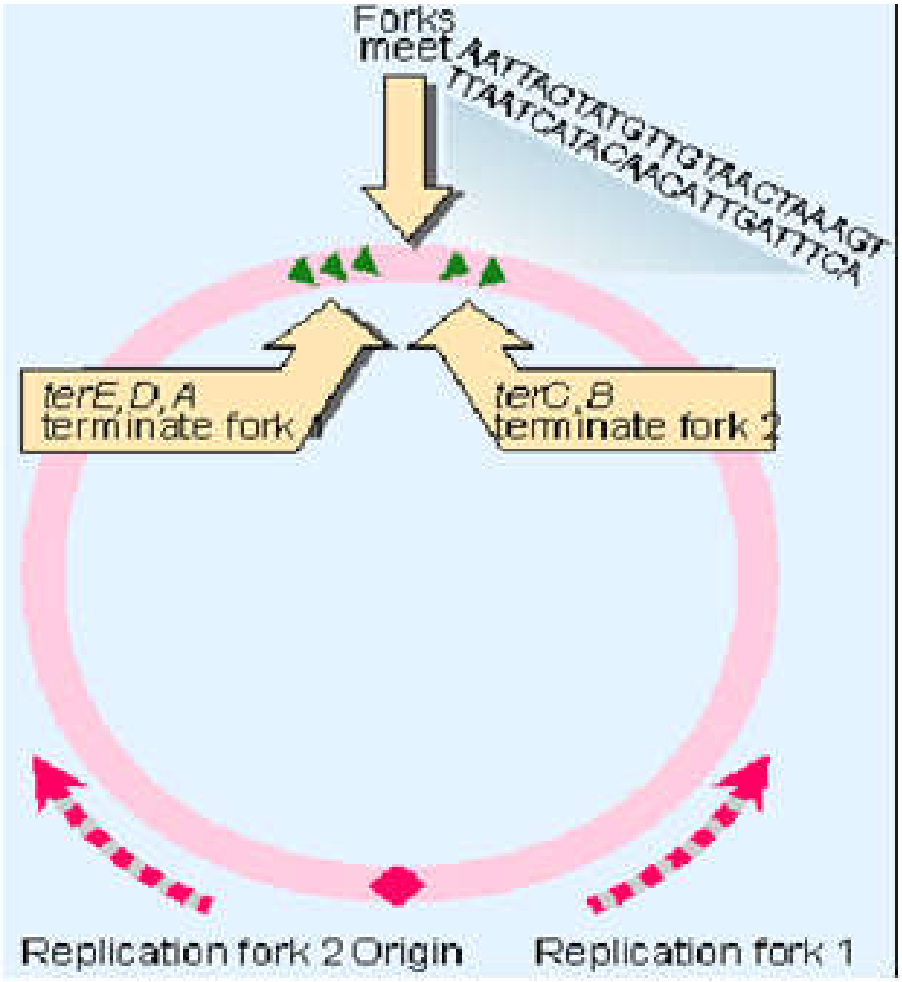

3′
5′
Parental strand
(a)
5′
3′
Progeny strand
Nick
Bind DNA polymerase I
(b)
Simultaneous removal of
primer and synthesis of
DNA to fill in the gap
(c)
Nick
Degraded
primer
DNA ligase
(d)

- **The replisome (复制体) is a complex molecular machine that carries out replication of DNA.**



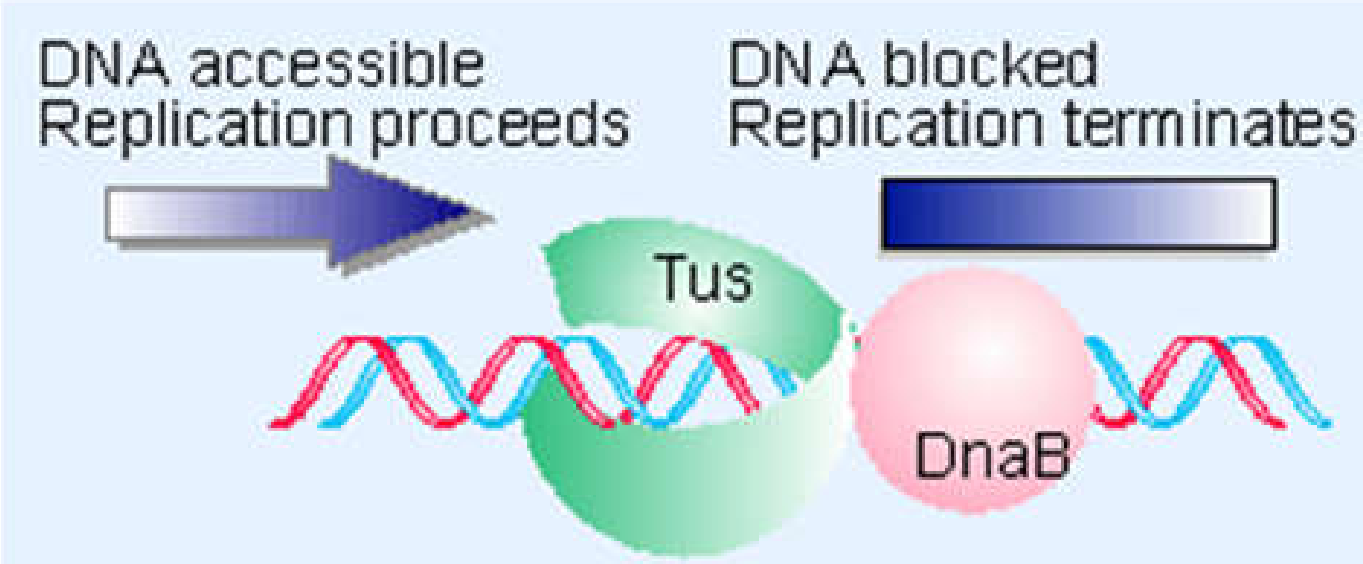
2.3 Termination

2.3.1 The termination region of the *E. coli* genome



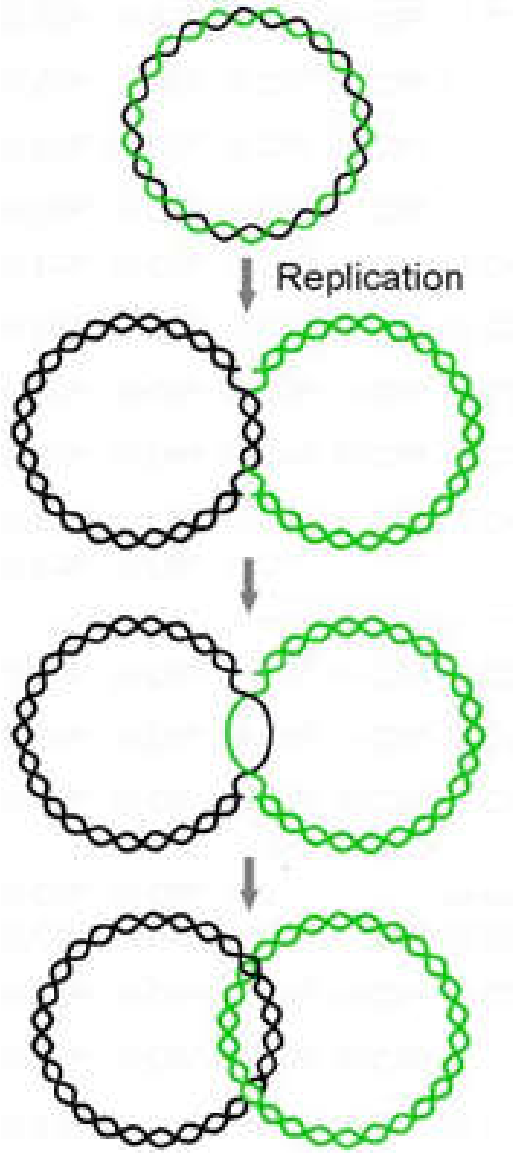
- **Termination site:** approximately 180° opposite *oriC*

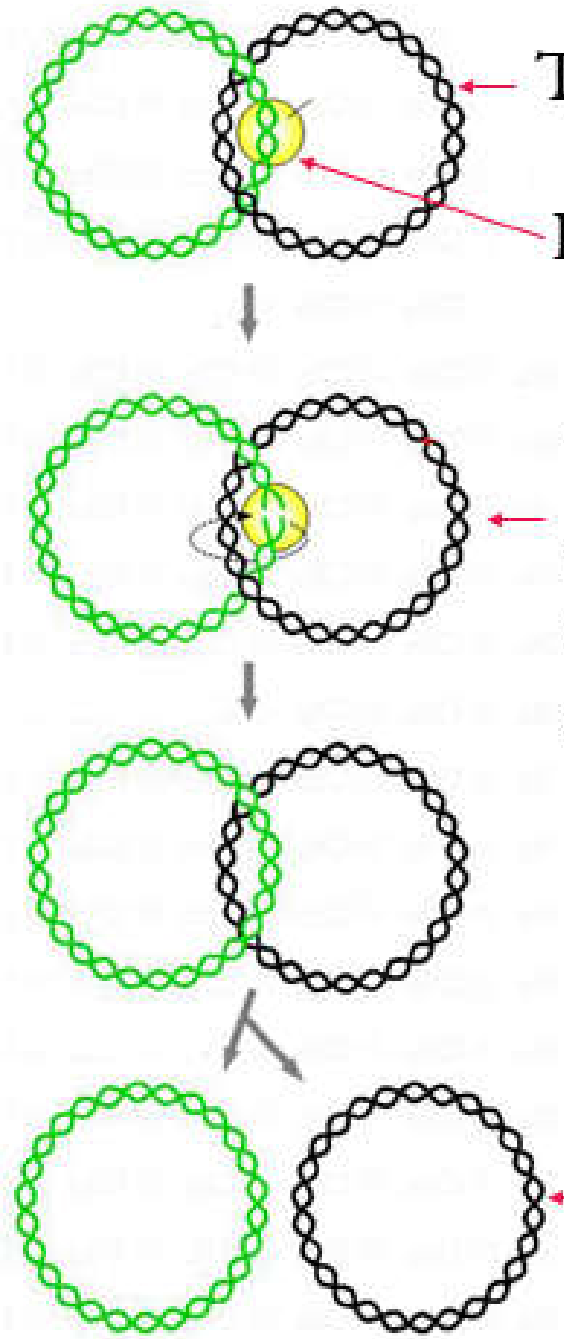
- **Tus protein is an inhibitor of the DnaB helicase.**



2.3.2 Segregation (分离)

- Because of the circular nature, the two daughter duplexes remain entwined (缠绕) as two interlocking rings, a type of catenane (连环体).





Two interlocked daughter DNA

Binding of Topo IV

Topo IV cause double strand break, allowing the other DNA circle to pass through the break, then rejoins the DNA strands to recreate the DNA circle.

Two separated daughter DNA