**Theta mode of replication**

A **Theta** structure is an intermediate structure formed during the **replication** of a circular DNA molecule (prokaryote DNA). Two **replication** forks can proceed independently around the DNA ring and when viewed from above the structure resembles the Greek letter "**theta**" (θ).

Replication initiation depends on a section of sequence known as plasmid origin of replication (ori). Rep proteins are plasmid-encoded initiators of replication, although some theta plasmids rely exclusively on host initiation factors for replication. Rep recognition sites typically consist of direct repeats or iterons, whose specific sequence and spacing is important for initiator recognition. Rep proteins are essential and rate-limiting for plasmid replication initiation.

Rep binding of ori iterons generally leads to the formation of a nucleoprotein complex that opens up the DNA duplex at the A+T-rich segment. In theta-type plasmids, Rep-mediated duplex melting leads to loading of DnaB on the replication fork, often with DnaA assistance.

After loading of DnaB, both DnaA-dependent and –independent modes of replication converge. In both cases, replisome assembly involves the following additional players: SSB (single-stranded binding protein), DnaB (helicase), DnaC (loading factor), the DnaG (primase), and the DNA polymerase III (Pol III) holoenzyme. SSB is recruited to exposed areas of single-stranded DNA, stabilizing them. DnaB is loaded onto the replication fork in the form of a complex with DnaC and recruits DnaG (the primase), which distributively synthesizes RNA primers for lagging-strand synthesis. Replisome assembly is completed by loading of the Pol III holoenzyme. This holoenzyme contains a core (with α, a catalytic subunit, and ε, a 3'→5’ exonuclease subunit), a β2 processivity factor, and a DnaX complex ATPase that loads β2 onto DNA and recruits the Pol III core to the newly loaded β2. DnaB helicase activity is stimulated through its interaction with Pol III and modulated through its interaction with DnaG, facilitating the coordination of leading-strand synthesis with that of lagging-strand synthesis during slow primer synthesis on the lagging strand.

* Termination of this process occurs when the replication forks reach the **ter sites**. Tus proteins (Terminus Utilization Substance) bind to ter sites and halt progression of forks. In *coli*, there are 10 replication termini (Ter sites) each spanning 23 bp
* Ter B and C terminate the clockwise fork while ter A, D and E terminate anti-clockwise fork
* In circular chromosomes, the daughter chromosomes remain interlocked and are called **catenanes**. Topoisomerase II resolves this problem by breaking some bonds in DNA molecules so as to separate the strands – **Decatenation**



