LINEAR BACTERIAL PLASMIDS

Summary

Completion of linear DNA replication requires a way to restore the original sequence and structure of linear DNA ends which can not be fully replicated by conventional DNA polymerases. In bacteria, the end replication problem has been circumvented through the use of circular plasmids and chromosomes. However linear bacterial plasmids and chromosomes have also been isolated. Their ends, commonly known as prokaryotic telomers, differ in structure from the ends of eukaryotic chromosomes and, during replication, become restored to their original form by a different mechanism. Two kinds of linear plasmids have been isolated: plasmids with covalently closed hairpin ends, and plasmids with invertron ends, which contain proteins bound to their 5' termini. The latter constitute the larger group and are commonly found in actinomycetous bacteria. They are usually conjugative and confer advantageous phenotypes. Plasmids with covalently closed ends are common in spirochetes of the genus *Borrelia.* A model plasmid of this group is prophage N15 of *Escherichia coli,* which exists in lysogens as a linear DNA molecule. The major difference between circular and linear plasmids is the presence in the latter of linear ends and proteins that specifically recognize those ends and are able to restore plasmid linearity during or after replication. Complete replication of invertron telomers depends on their 5' end-associated proteins but its mechanism is still unclear. Plasmids with covalently closed ends are completely replicated from an internal origin to form circular dimeric molecules that can be observed as replication intermediates. Further processing of the intermediates depends on telomere resolution, a DNA breakage and reunion reaction, in which opposite strands of replicated telomeres are cleaved and rejoined to form covalently closed ends of two progeny molecules.