Summary

Partitioning of low-copy number plasmids at cell division resembles mitosis in that prior to cell division paired plasmid molecules are separated from each other and actively moved apart from the center of the mother cell into positions corresponding to the centers of future daughters. Two plasmid proteins and a *cis*-acting site in plasmid DNA, an analog of eukaryotic centromere, are essential for partitioning to occur. Typically, partition proteins are encoded within an operon whose expression is regulated by one or both of its products. The product of the first gene of the partition operon (ParA, SopA or ParM) is an ATPase, the product of the second gene (ParB, SopB or ParR) is a centromere-binding protein. Partitioning ATPases belong to the Walker-type or actin-type ATPase families. They interact with their target centromeric complexes indirectly, *via* plasmid specific centromere- binding proteins. Two types of partitioning ATPases may provide two different ways of plasmid translocation within a cell. The movement of plasmid Rl, which encodes the actin-type ParM ATPase, is associated with extension of ParM filaments at their polar end and depolymerization at the opposite end. Extension might possibly occur by insertion of new ParM molecules between the centromere-bound ParR proteins of paired Rl plasmids and ParM molecules bound to ParR, thus pushing the plasmids towards the opposite cell poles. The role of Walker-type ATPases in plasmid translocation is not clear. In their structure they resemble some ion pump proteins. They may either participate in plasmid movement by themselves or connect plasmids to unknown partition machinery of a host. Some of them can oscillate between cellular poles, reminiscent of the behavior of related bacterial proteins, MinD, that specify the sites of septum placement.

Partitioning mechanisms in bacteria are evolutionarily conserved and of universal occurrence. Plasmid partition operons with centromeric sites can function as gene cassettes able to stabilize other unstable low-copy number plasmids. Certain bacterial chromosomes encode homologs of plasmid partition genes essential for chromosome partitioning.