ID de Contribution: **12** Type: **Non spécifié**

Replicon dynamics during the cell cycle in Escherichia coli

During cell cycle, the bacteria must transmit all the genetic information it contains to its daughter cells. To do this, the chromosome and the plasmids, which form the replicons, must be duplicated through replication, then segregated in each daughter cell. However, replication and segregation events must be finely coordinated with cell division. Many proteins are involved in the regulation of this cell cycle notably the MatP protein, and its DNA binding site matS, which participates in the positioning of the ter regions of sister chromatids at the center of the cell [1]; and the recombinases XerC and XerD which separate dimers formed at the end of replication, by site-specific recombination at the dif site [2]. Nevertheless, the entire mechanisms that drive the regulation is not fully understood. It is known that a lot of proteins involved in this regulation can interact with the Topoisomerase IV (TopoIV). TopoIV is an heterotetrameric (ParC2ParE2) ATPase-dependent complex, which has a key role in the regulation of the cell cycle through its catenane and pre-catenane resolution activity [3]. Catenanes are interlinked DNA molecules, and these links must be removed to allow their segregation. To better understand the decatenation activity in vivo, I use the model bacterium Escherichia coli with Temperature sensitive mutants of TopoIV. Their activity is investigated by analyzing the accumulation of plasmid catenanes at non-permissive temperature, as well as their resolution by the recovering TopoIV. Experiments are carried out with pUC18, which is a small (2.7kb) plasmid with a high copy number; and its derivative pMIN33 where a dif site has been added. We know that TopoIV activity is strong at this site [4]. To study the effect of MatP on the activity of TopoIV, a matS site has been added on these plasmids. My results suggest that the presence of matS and dif sites on the plasmid can improve its decatenation, but also that the combination of matS and dif have a synergic effect on TopoIV activity.

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Classification de Session: Oral