Nature Reviews Microbiology | AOP, published online 28 April 2008; doi:10.1038/nrmicro1911

DNA REPLICATION

Follow the path

According to the prevailing view of DNA replication, DNA is delivered to, and then replicated in, fixed cellular 'replication factories'. However, the movement of replisomes (the replication machinery that is located at the replication forks) in live *Escherichia coli* cells, report David Sherratt and colleagues in *Cell*, suggests an opposing model of DNA replication: highly dynamic replisomes track along compacted DNA during replication.

To examine how replication proceeds in *E. coli*, Sherratt and colleagues fluorescently labelled the replisome component Ssb (single-strand binding protein) so that replisomes, and therefore replication forks, could be tracked in live cells. Using time-lapse imaging, the authors observed an initial single Ssb focus at mid-cell, where the origin of replication is located. After 5 minutes, 59% of cells had 2 Ssb foci, usually in different halves of the cell, suggesting that replication occurs bidirectionally, with the 2 forks moving in opposite directions. After 10 minutes, 76% of cells had 2 Ssb foci. Near the end of replication, at the last time point before the replisome foci disappeared, 62% of cells once again had a single focus in the centre of the cell, compared with 18% of cells 5 minutes earlier. These findings, the authors suggest, indicate that there are initially two adjacent replisomes, but that these replisomes follow different paths into opposite halves of the cell during replication and then come back together at the end of replication.

To take a closer look at the movement of these replisomes, the authors carried out 3-second and 30-second time-lapse series of Ssb localization. Notably, the position of the foci changed constantly. On average, the replisome moved ~100 nm every 3 seconds along the long axis of the cell.

As chromosomal DNA can also be highly dynamic in the cell, replisome movement may just be a consequence of DNA movement. To test this possibility, the authors tracked the movement of the replisome in relation to two genetic loci. If DNA is passing through a fixed replisome, there should be more DNA movement than replisome movement. If the replisome tracks along DNA, however, there should be more replisome movement. Indeed, the Ssb loci exhibited a greater mean movement than the genetic loci, supporting the notion that the replisome tracks along DNA.

These data, and the moving replisome model they propose, are not consistent with the notion of fixed replication factories. The authors speculate that the use of live-cell imaging, rather than the analysis of fixed cells, could explain differences in the data that support the different models. The authors argue that their results "provide a strong experimental basis … for discarding the idea that *E. coli* replication occurs in fixed replication factories."

Asher Mullard

ORIGINAL RESEARCH PAPER Reyes-Lamothe, R., Possoz, C., Danilova O. & Sherratt, D. J. Independent positioning and action of *Escherichia coli* replisomes in live cells. *Cell* **133**, 90–102 (2008)