

# Formation and 3D dynamics of replication factories

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A key stage of the cell life is the S-phase, when DNA is replicated. It is now well established that replication of chromosomes begins with the assembly of multi-protein machines, the replisomes, at specific chromatin sites known as replication origins. The 3D dynamics of replisomes during the S-phase is not completely understood yet. Microscopy experiments showed how replisomes tend to form clusters, often called replication factories, which increase in size and decrease in number during the replication process [1,2].

Here I will present recent Molecular Dynamics simulations of a polymer model developed to understand the dynamics of replication factories and the underlying mechanisms leading to their formation and growth. We discovered a new growth pathway involving the formation of long-range chromatin loops which was not predicted by previous experiments. Moreover, a statistical mechanics calculation explains the importance of attractive interactions between replisomes and the whole chromatin fibre, not only replication origins, in order to observe the aggregation of replisomes and the formation of replication factories.

## References

- [1] H. Nakamura, T. Morita, C. Sato, Structural organizations of replicon domains during DNA synthetic phase in the mammalian nucleus. *Exp. Cell Res.*, 165(2), 291–297 (1986).
- [2] P. Hozák, D.A. Jackson, P.R. Cook, Replication factories and nuclear bodies: the ultrastructural characterization of replication sites during the cell cycle. *J. Cell Sci.*, 107(8), 2191–2202 (1994).