Key proteins keep DNA regions close for longer

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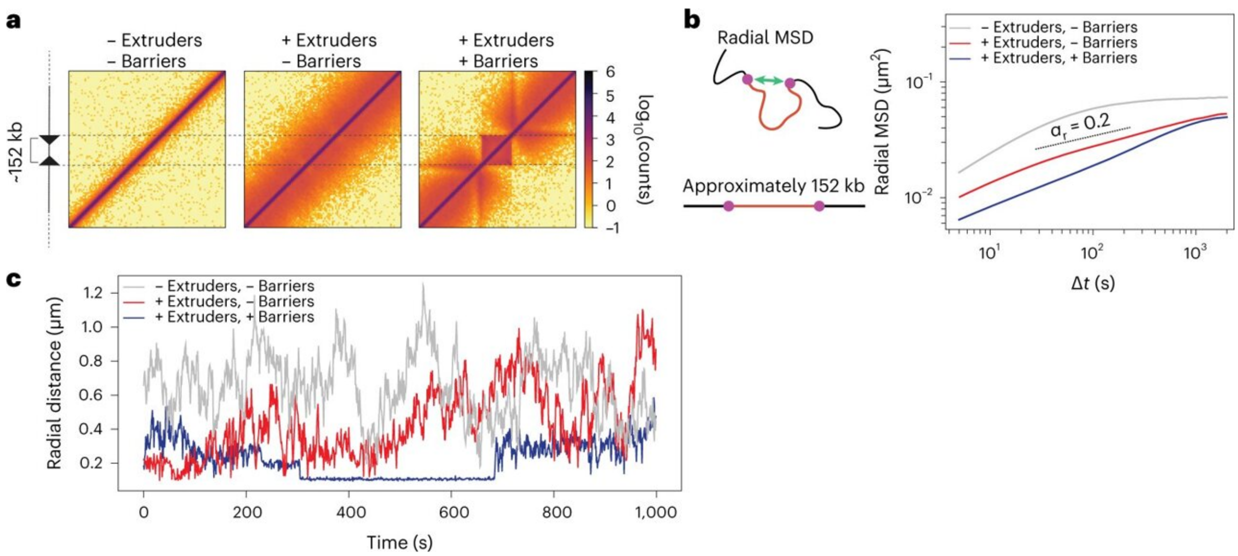

Convergent CTCF sites further constrain polymer dynamics. a, Simulated contact maps of a region spanning the equivalent of 800 kb for a polymer chain without loop extrusion, with loop extruders and with convergent extrusion barriers separated by the equivalent of 152 kb. b, Radial MSD of the two monomers separated by the equivalent of 152 kb in the three conditions from panel a. Dashed line is an exponent of 0.2 as a guide to the eye (αr indicates the slope of radial MSDs). Loop extrusion parameters as in Fig. 2c. c, Representative examples of distances between the two monomers in simulations with or without loop extrusion and extrusion barriers. The flat stretch in the trajectory with extrusion and barriers corresponds to a loop anchored by the two barriers. Credit: *Nature Genetics* (2022). DOI: 10.1038/s41588-022-01232-7

New work by Friedrich Miescher Institute researchers shows that key proteins help to stabilize the interaction between otherwise highly dynamic DNA structures. The findings shed light onto how the complex folds that help to fit nearly two meters of DNA into the cell's nucleus influence important biological processes.

The genome is organized into 3D structures that can control gene expression by bringing genes together with their regulatory elements. However, it is unknown if contacts between DNA sequences are rare and stable or if they are frequent and transient.

Researchers in the group of Luca Giorgetti tagged sequences within self-interacting DNA regions with fluorescent proteins. Then, they watched how the sequences interacted with each other in living cells over several hours.

The researchers found that the DNA sequences frequently came into close proximity, but they stayed next to each other only for a few minutes. The contacts became longer and more frequent in the presence of the cohesin protein complex and of DNA snippets that are typically bound by a protein called CTCF. In the cell, CTCF and cohesin help to shape the DNA molecule into loops of various sizes.

The team also developed physical models of chromosome dynamics, which suggest that DNA loops that are pinched together by CTCF can last up to 15 minutes.

The paper is published in the journal *Nature Genetics*. The findings shed light onto how these complex folds influence key processes such as the regulation of gene expression.

More information: Pia Mach et al, Cohesin and CTCF control the dynamics of chromosome folding, *Nature Genetics* (2022). DOI: 10.1038/s41588-022-01232-7

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