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Spatial organization and dynamics of interphase yeast chromosomes[1] BARIS AVSAROGLU, Dept of Physics, Brandeis Uni, Waltham MA, SUSANNAH GORDON-MESSER, Dept of Biology, Brandeis Uni, Waltham MA, MIRIAM FRITSCHE, Inst fur Theoretische Physik, Heidelberg University, Heidelberg Germany, JUNGOH HAM, Dept of Biology, Brandeis Uni, Waltham MA, DIETER W. HEERMANN , Inst fur Theoretische Physik, Heidelberg University, Heidelberg Germany, JAMES E. HABER , Dept of Biology and Rosenstiel Center, Brandeis Uni, Waltham MA, JANE KONDEV, Dept of Physics, Brandeis Uni, Waltham MA — Understanding how the genome is spatially organized is an important problem in cell biology, due to its key roles in gene expression and DNA recombination. Here we report on a combined experimental and theoretical study of the organization and dynamics of yeast chromosome III which has a functional role in the yeast life cycle, in particular, it is responsible for mating type switching. By imaging two fluorescent markers, one at the spindle pole body (SPB) and the other proximal to the HML locus that is involved in DNA recombination during mating type switching, we measured the cell to cell distribution of distances and the mean square displacement between the markers as a function of time. We compared our experimental results with a random-walk polymer model that takes into account tethering and confinement of chromosomes in the nucleus, and found that the model recapitulates the observed spatial and temporal organization of chromosome III in yeast in quantitative detail. The polymer model makes specific predictions for mating-type switching in yeast, and suggests new experiments to test them.

Baris Avsaroglu
Dept of Physics, Brandeis Uni, Waltham MA

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