Active deformation dynamics of cell nuclei contribute to the formation of intra-nuclear chromosome architectures

October 14 2015

A Japanese researcher has investigated the contributions of active deformation dynamics of cell nuclei using the Brownian motion theory.

There are two types of chromatin, euchromatin and heterochromatin, that vary with the stages of the cell cycle. In particular, euchromatin with rich active genes localizes to the interior of the nucleus during interphase; heterochromatin usually localizes to the periphery of the nucleus. Akinori Awazu, an Associate Professor at the Research Center for Mathematics on Chromatin Live Dynamics (RcMcD) has investigated the contributions of active deformation dynamics of cell nuclei to the intra-nuclear positioning of euchromatin and heterochromatin using the Brownian motion theory.

Professor Awazu analyzed the behaviors of model chains containing two types of regions (representing euchromatin and heterochromatin); one with high and the other with low mobility. These chains were confined in a pulsating container that was representative of a nucleus exhibiting dynamic deformations. The simulations demonstrated that the low mobility regions transition from sites near the periphery to the central region of the container if the affinity between the low mobility regions and the container periphery disappears, as observed in the nocturnal mouse rod cell nucleus.

This result indicates that in addition to the previously proposed inter-

chromatin interactions, active nuclear deformations contribute considerably to the determination of intra-nuclear chromosome architectures. Professor Awazu believes that further detailed theoretical studies on segregation pattern formation are important to understand the biophysics of chromosomes and practically apply soft matter and statistical physics in the future.

More information: Akinori Awazu. "Nuclear dynamical deformation induced hetero- and euchromatin positioning," *Physical Review E* (2015). DOI: 10.1103/PhysRevE.92.032709

Provided by Hiroshima University