Title
Tracking the Mechanical Dynamics of Stem Cell Chromatin

Permalink
https://escholarship.org/uc/item/56799526

Journal
BIOPHYSICAL JOURNAL, 104(2)

ISSN
0006-3495

Authors
Hinde, E
Cardarelli, F
Chen, A
et al.

Publication Date
2013-01-29

License
CC BY 4.0

Peer reviewed
1030-Plat
Tracking the Mechanical Dynamics of Stem Cell Chromatin
Elizabeth Hinde1, Francesco Cardarelli2, Aaron Chen3, Michelle Khine3, Enrico Gratton1.

1Laboratory for Fluorescence Dynamics, University fo California, Irvine, CA, USA, 2Center for Nanotechnology Innovation @NEST, Istituto Italiano di Tecnologia, Pisa, Italy, 3University fo California, Irvine, CA, USA.

A plastic chromatin structure has emerged as fundamental to the self-renewal and pluripotent capacity of embryonic stem (ES) cells. Direct measurement of chromatin dynamics in vivo is however challenging as high spatiotemporal resolution is required. Here we present a new tracking based method which can detect chromatin fiber movement and quantify the mechanical dynamics of chromatin in live cells. We use this method to study how the mechanical properties of chromatin movement in hESCs are modulated spatiotemporally during differentiation into cardiomyocytes (CM). Notably, we find that pluripotency is associated with a highly discrete, energy-dependent frequency of chromatin movement, that we refer to as a “breathing” state. We find that this “breathing” state is strictly dependent on the metabolic state of the cell and is progressively silenced during differentiation, thus representing a hallmark of pluripotency maintenance. This is a result that could not have been observed without the nanometer resolution provided by this novel tracking method.