سمینار هفتگی ماده چگال نرم

Mechanical and non-equilibrium characteristics of the nuclear membrane of stem cells

Sedigheh Ghanbarzadeh Nodehi

Institute for Advanced Studies in Basic Sciences, Zanjan, Iran

Abstract

Embryonic stem (ES) cells have the capacity to differentiate into all cell lineages in vivo, and because of this, the nucleus and the chromatin are kept poised in a particular dynamical state enabling such transitions. Research has shown that the nuclei of stem cells are very soft due to a low level of structural proteins such as lamin A/C and transcriptionally highly active state. In this study, we use the live data of ES cell nuclei in culture obtained by confocal microscopy with a temporal resolution of 10 s and study the shape fluctuations of the nuclei on a time scale of tens of minutes. We quantitatively describe the shape fluctuations using the mean-squared amplitude of the nuclear membrane and find that the fluctuations are not homogeneously distributed along the membrane contour. In addition, we introduce an angular autocorrelation function of the fluctuations as an indicator of the material properties of the nuclei. Performing the Fourier analysis of the nuclear shape, we demonstrate that the lower order modes have a dominant contribution. We finally illustrate that the dynamics of these modes can be expressed in terms of the dynamics of the perimeter of the nuclear cross section and find an explanation for the damped oscillatory behavior in the autocorrelation of the perimeter. Our findings may help characterize the nuclear dynamics of ES cells and provide a framework to monitor the nucleus state in different conditions.

زمان: شنبه ۱۴۰۰/۳/۸ ساعت ۱۵:۳۰

مکان(کلاس مجازی آقای دکتر اجتهادی) :

https://vclass.ecourse.sharif.edu/ch/ejtehadi