

Establishing a relation among the projected area, surface area and volume of the nucleus of a cell using a non-dimensional mechanical model

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ABSTRACT

The aim of this project was to establish a relation among the projected area, surface area and volume of the nucleus of a cell using a non-dimensional mechanical nuclear model, which was based on two non-dimensional parameters, η_1 and η_2 . The relation was given by a model surface in a three dimensional plot with the 3 axes being normalized projected area, normalized surface area and normalized volume. The relation has been previously verified for Huh7 cell line and Hepatitis C Virus (HCV) infected Huh7 cell lines. This project was to see if the relation predicted by the model was true for other cell lines, perturbations in the cytoskeleton and for different cell-substrates. The other cell lines used were 3T3, HEK- 293E, MCF-7 and MDA-MB231 cell lines. Perturbations in the cytoskeleton were introduced by treating the cells with Cytochalasin D and Nocodazole. The cell substrates included normal coverslip and coverslips that were microfabricated with cell stretchers. The imaging was done under a confocal microscope and the images were analysed using a previously developed image processing code. The morphological parameters thus obtained were seen to fit in the model for all the cases considered, thereby establishing the relationship among projected area, surface area and volume of the nucleus of a cell as given by the non-dimensional mechanical nuclear model. Now the non-dimensional parameters obtained by fitting this model to the nuclear morphology could be used for estimating cell properties.