Does nucleus play a role in the collective cell migration?

(1) Establish a scratch assay of cell migration using NIH 3T3

(i) Culture NIH 3T3 in well plate (in confluent manner)

(ii) Stain with Nucblue

(iii) Apply the scratch and visualize under the microscope

(iv) Quantify – directionality, persistence, closure potential etc.

(v) Might need actin staining for answering some questions

Repeat some of the above experiments with MSC

(2) Validate the technique using one or two blockers such as cyto-D (blocks actin) or Y27 (blocks myosin II)

(3) Apply drugs that change the nuclear stiffness and chromatin remodeling and see how the above numbers in (1) change

(4) Do live imaging of cytoskeleton and nucleus at high resolution and quantify strain map in the cell monolayer both at the nucleus and the cytoplasm

Further questions:

How cell crowding effect is affected by the nuclear mechanics (single vs collective migration)

Can we play the substrate mechanics and answer some exciting questions?

Further reading:

For some of the quantification in point 1, see <https://pubmed.ncbi.nlm.nih.gov/23091067/>

Learn how to use the ImageJ/ Fiji tracker

Some other interesting ideas about how the nucleus works as a piston:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5248932/>

<https://rupress.org/jcb/article/216/1/93/46133/Activating-the-nuclear-piston-mechanism-of-3D>

<https://advances.sciencemag.org/content/7/2/eabd4058>