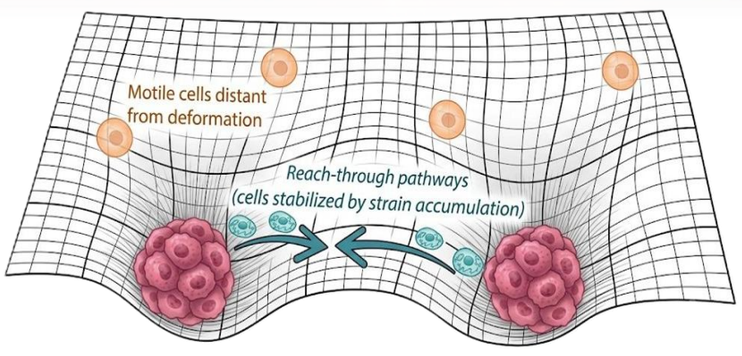
INVESTIGATING CELL-MATERIAL INTERACTION FOR THE STUDY OF CELL MIGRATION INDUCED BY SUBSTRATE SPACE-TIME WARPING

Adele Magi, Wendy Balestri , Ludovica Cacopardo

Department of Information Engineering and Research Center 'E. Piaggio' - University of Pisa - Pisa

Cell–material interactions are crucial for cell migration, yet the influence of **substrate biochemical functionalization** remains poorly standardized [1].

Within the framework of the INTERCELLAR project, this preliminary study investigates cell adhesion, morphology and migration on **soft viscoelastic substrates functionalized with different coatings.**



Methodology

Cells: ADSC in 2D condition
Substrate: 5 mg/ml **agarose** and 20 mg/ml **dextran** gels [2] with different coatings.
Imaging: ZenCellOwl

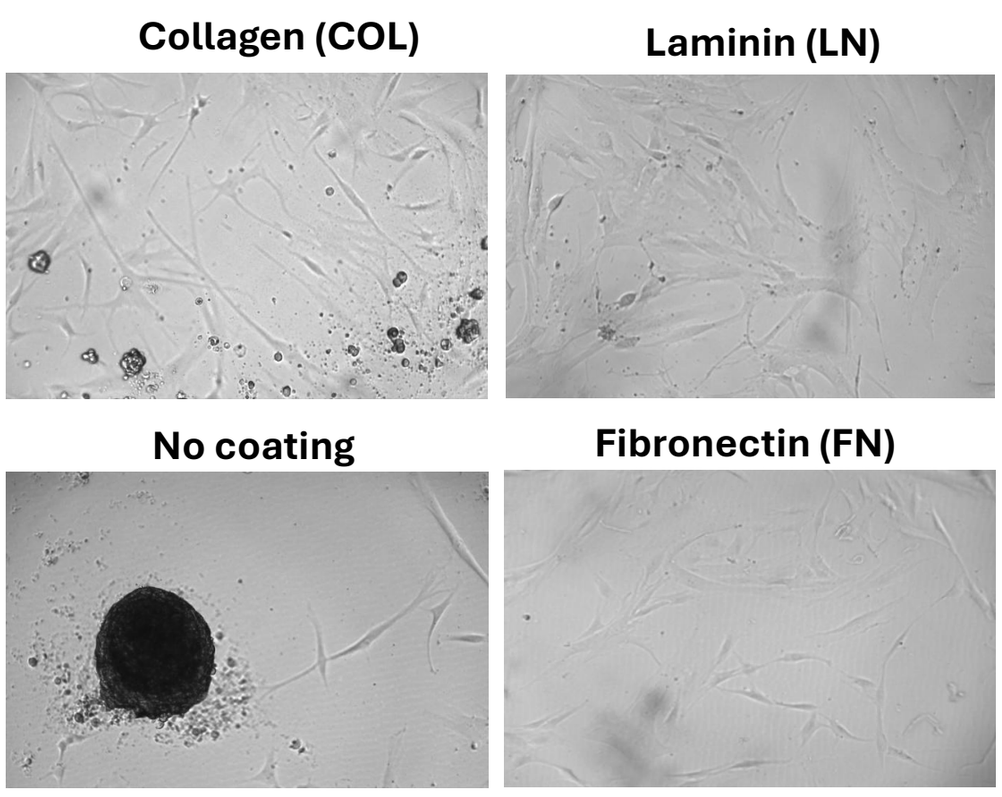


Figure 1: Results Day 3 – acquisition every 2 minutes for 1hour, 30.000 cells/cm²

Cells: ADSC spheroids
Substrate: ULA for 24h -> gels with coatings
Imaging: Bright field (Nikon) at day 1 and 6

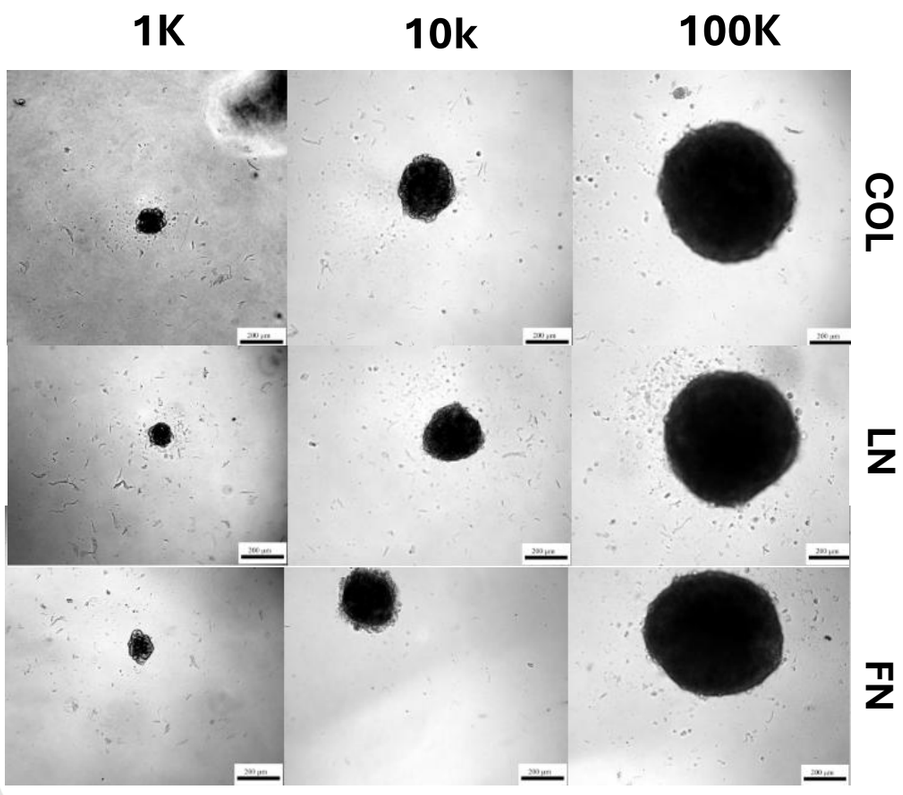
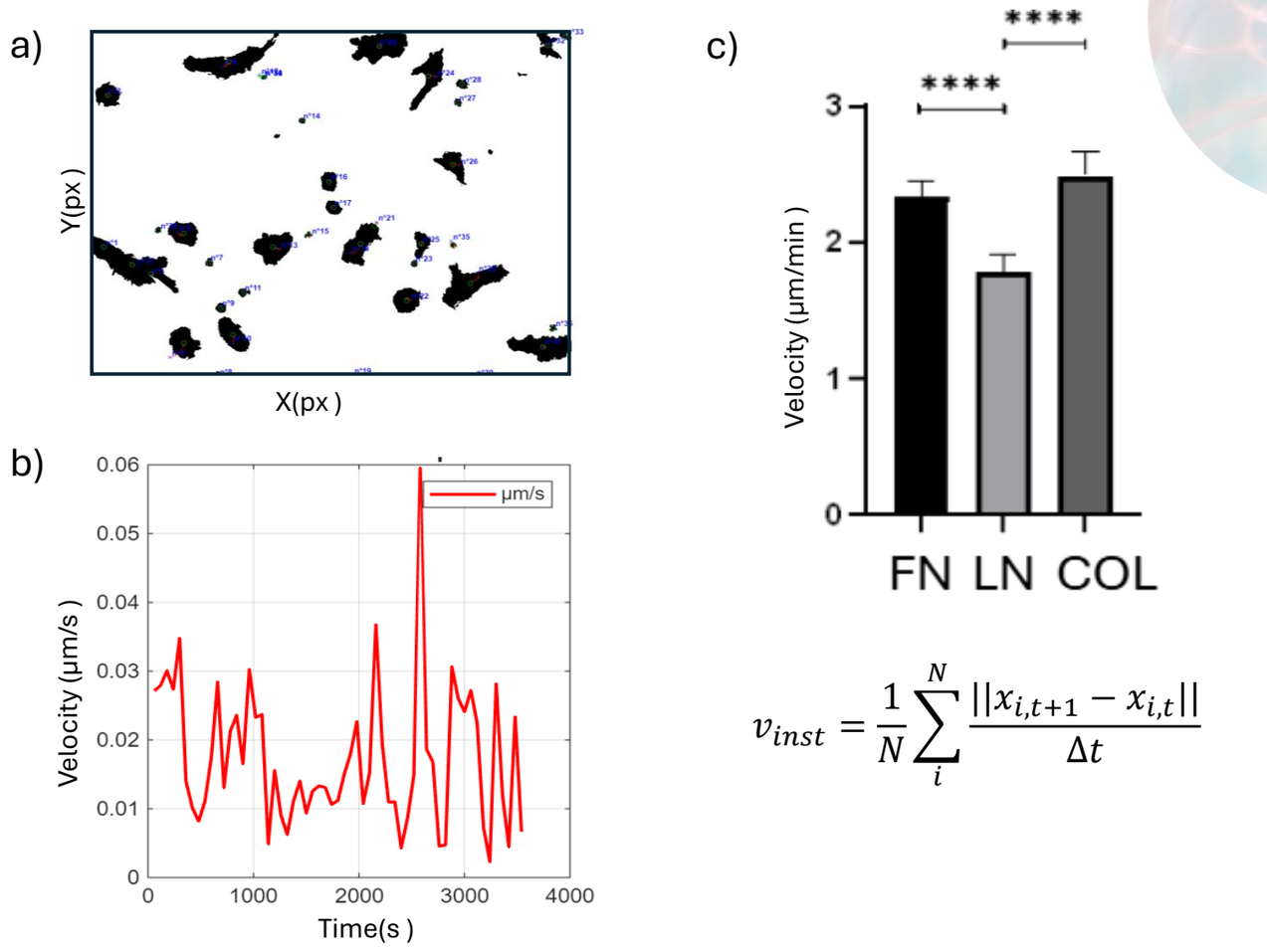


Figure 2: Spheroids on gel, day one (scale = 200 µm)

Results

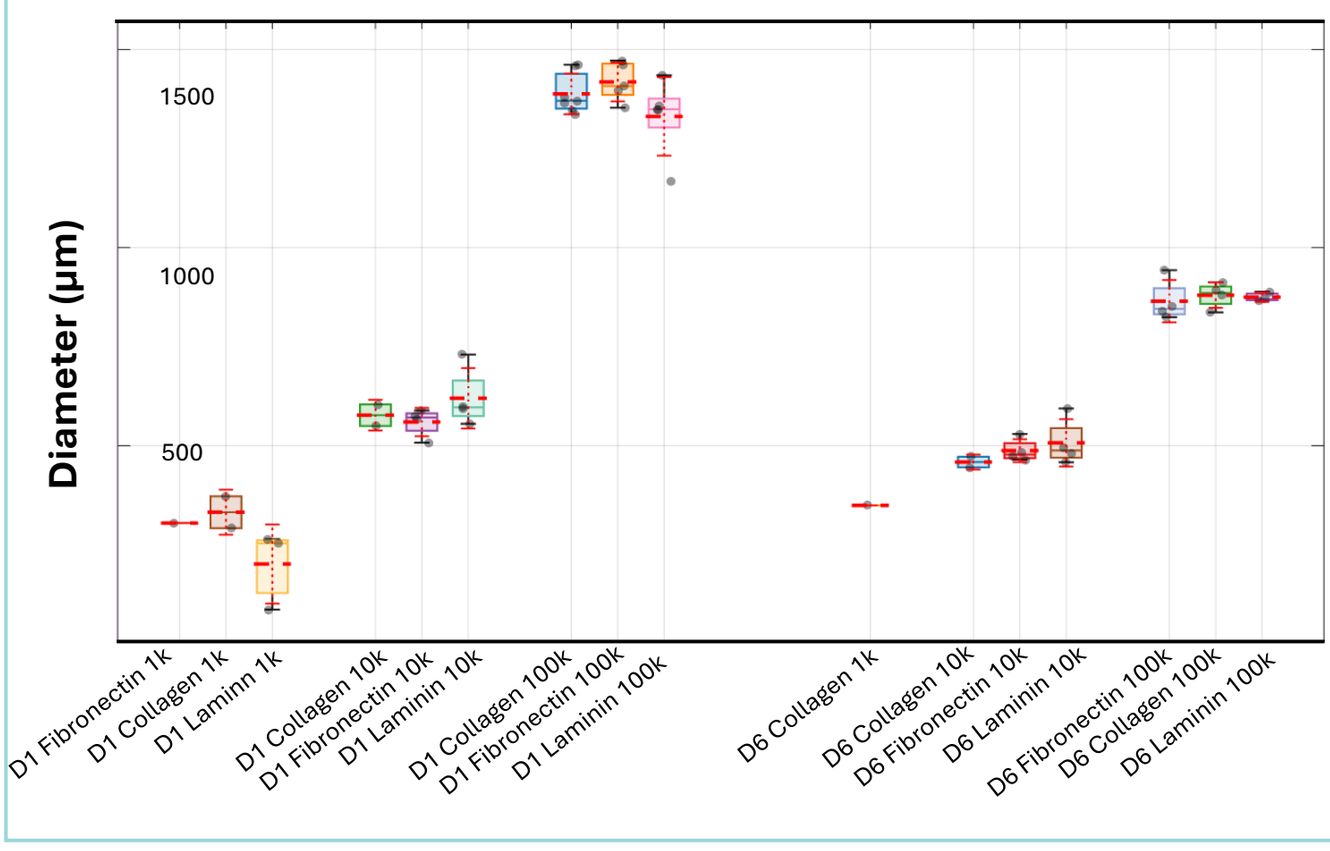
ZenCellOwl acquisitions were segmented using CNNs. Generated masks served as input for MATLAB-based cell tracking.



$$v_{inst} = \frac{1}{N}\sum_{i}^{N}\frac{||x_{i,t+1} - x_{i,t}||}{\Delta t}$$

Figure 3: a) Final frame mask overlaid with cell trajectories, gel with FN , day 3 b) Average cell velocity over time on gel with FN, day 3 c) Mean instant velocity of cells on the three coatings.

A platform was developed to segment spheroids images and extrapolate spheroids' features (diameter, perimeter, area, shape index, circularity)



References

1. Zhang et al., Acta Biomat, 2019.
2. Cacopardo et al, JMBBM, 89:163-167, 2019.

Future work

- Selection of optimal substrate for investigating cell migration
- Quantification of **substrate deformation over time and** space

This work aims at understanding cell-induced substrate warping as a **contactless mechanism for directing cell migration**.

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adele.magii@phd.unipi.it