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## PERSISTENT RANDOM WALK MODEL OF CELL MIGRATION OVER CURVED SURFACE

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### INTRODUCTION

Cell migration is a key process in tissue formation which occurs during embryo development or regeneration. Among the numerous factors that impact cell behavior, substrate cell-scale curvature redirects cells toward concave areas [1] (Fig.1). Yet, the mechanism driving this directional change remains elusive-whether it emerges from signal pathway activation induced by curvature and/or mechanical constraints imposed by curvature.

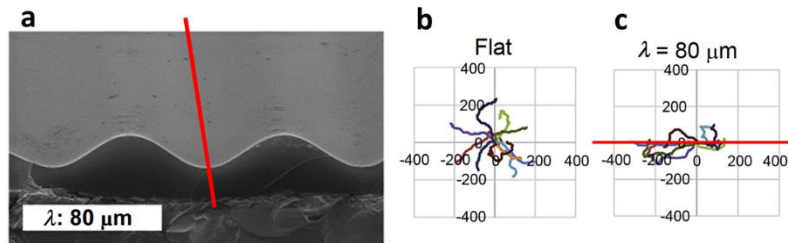


Figure 1: a. Sinusoidal wavy substrate with a wavelength (distance between two consecutive peaks) of  $80\mu\text{m}$ . b. c. Trajectories of T-cells cultivated on flat and wavy substrates. Cells predominantly migrate along the valleys (indicated by red axes) on the wavy substrate. Images reproduced from [1].

### MATERIALS AND METHODS

Here, a persistent random walk (PRW) model [2] has been developed in order to assess the mechano-sensitivity of cells to substrate curvature. A parameter  $\beta \in [0,1]$  regulates whether curvature activates signal pathways ( $\beta$  close to 1) or not ( $\beta$  close to 0). Sensibility to curvature may arise from a local gradient measurement at the cell's position or a cell-scale measurement at the periphery. Our study aims to test all these hypotheses.

### RESULTS

Simulations were conducted for 10 hours on a sinusoidal wavy surface with an amplitude of  $10\mu\text{m}$  and a wavelength  $\lambda = 80\mu\text{m}$  (Fig. 2).

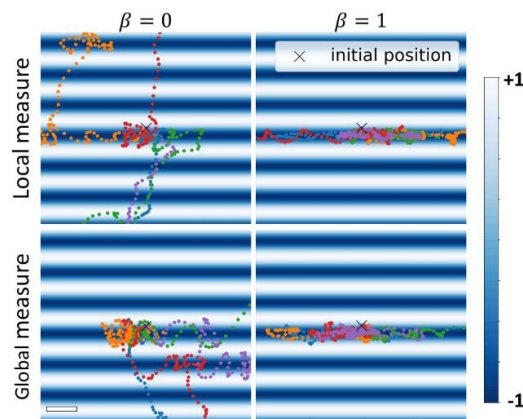


Figure 2: Trajectories of five cells under different parameters conditions. Scale bar is  $80\mu\text{m}$  and color bar is the normalized height of the substrate (+1 is peaks and -1 is valleys).

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Preliminary results, when compared with experiments (Fig. 1c), suggest that cells change of directionality is mostly caused by signal pathway activation ( $\beta$  close to 1).

## DISCUSSION AND CONCLUSIONS

The PRW model reproduces cell trajectories on curved surface. A numerical study [3] showed that dynamic surfaces can guide cell migration in a given direction. Adapting the PRW model to dynamic substrates can reinforce the development of methods to guide cell migration.

## References

- [1] Song, K. H., Park, S. J., Kim, D. S., Doh, J.: *Sinusoidal wavy surfaces for curvature-guided migration of T lymphocytes*. Biomaterials, 2015.
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