Mechanical coordinates: designing geometrical microenvironments for the control mechanical waves in model tissues.

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Correct development of organisms starting from single cells is an extremely complex and regulated process, whose characteristic landmarks are associated to spatial patterning of cell behavior. Precise and correct occurrence of these behavioral changes is generally attributed to signaling programs, but we recently discovered that mechanical tensions are responsible for many phenomena typical of morphogenesis, such as gastrulation, branching and buckling. [1] In particular, mechanical waves have been observed in expanding as well as colliding two-dimensional epithelial tissues. [2,3] These findings suggest that the presence of peculiar wave-like patterns might be of a more common nature, and that it might be of interest to fully understand morphogenesis and its guidance.

Here we intend to investigate the occurrence of mechanical waves in confined tissues and their correlation with the presence of boundaries. We use microfabrication techniques to confine the growth of model tissues to specific geometries, chosen for their ability to induce coherent long range cell alignment, and Traction Force Microscopy (TFM) to monitor tissue-substrate interaction in relation to the particular shape chosen. Longer observations carried out with lensless microscopy allow to study the dynamics of the system and correlate the wavelike phenomena observed to characteristic motion and jamming transition typical of epithelial cells.

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