Year of publication 2018

Coscoy S, Baiz S, Octon J, Rhoné B, Perquis L, Tseng Q, Amblard F, Semetey V. (2018 Oct 16)
Microtopographies control the development of basal protrusions in epithelial sheets
Biointerphases : 13 : 041003 : DOI : 10.1116/1.5024601

Summary

Venzac B, Madoun R, Benarab T, Monnier S, Cayrac F, Myram S, Leconte L, Amblard F, Viovy JL, Descroix S, Coscoy S (2018 Oct 16)
Engineering small tubes with changes in diameter for the study of kidney cell organization
Biomicrofluidics : 12 : 024114 : DOI : 10.1063/1.5025027

Summary

Blanch-Mercader C., Yashunsky V., Garcia S., Duclos G., Giomi L., Silberzan P. (2018 Oct 9)
Turbulent dynamics of epithelial cell cultures
Phys. Rev. Lett. : 120 : 208001 : DOI : 10.1103/PhysRevLett.120.208101

Summary

We investigate the large length and long time scales collective flows and structural rearrangements within in vitro human bronchial epithelial cell (HBEC) cultures. Activity-driven collective flows result in ensembles of vortices randomly positioned in space. By analyzing a large population of vortices, we show that their area follows an exponential law with a constant mean value and their rotational frequency is size independent, both being characteristic features of the chaotic dynamics of active nematic suspensions. Indeed, we find that HBECs self- organize in nematic domains of several cell lengths. Nematic defects are found at the interface between domains with a total number that remains constant due to the dynamical balance of nucleation and annihilation events. The mean velocity fields in the vicinity of defects are well described by a hydrodynamic theory of extensile active nematics.

Duclos G., Blanch-Mercader C., Yashunsky V., Salbreux G., Joanny J.-F., Prost J., Silberzan P. (2018 Oct 3)
Spontaneous shear flow in confined cellular nematics
Nature Physics : DOI : 10.1038/s41567-018-0099-7

Summary

In embryonic development or tumour evolution, cells often migrate collectively within confining tracks defined by their microenvironment[1,2]. In some of these situations, the displacements within a cell strand are antiparallel[3], giving rise to shear flows. However, the mechanisms underlying these spontaneous flows remain poorly understood. Here, we show that an ensemble of spindle-shaped cells plated in a well-defined stripe spontaneously develops a shear flow whose characteristics depend on the width of the stripe. On wide stripes, the cells self-organize in a nematic phase with a director at a well-defined angle with the stripe's direction, and develop a shear flow close to the stripe's edges. However, on stripes narrower than a critical width, the cells perfectly align with the stripe's direction and the net flow vanishes. A hydrodynamic active gel theory provides an understanding of these observations and identifies the transition between the non-flowing phase oriented along the stripe and the tilted phase exhibiting shear flow as a Fréedericksz transition driven by the activity of the cells. This physical theory is grounded in the active nature of the cells and based on symmetries and conservation laws, providing a generic mechanism to interpret in vivo antiparallel cell displacements.