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Density fluctuations and intercellular fluid flow in epithelial monolayers STEVEN ZEHNDER, MELANIE SUARIS, THOMAS ANGELINI, University of Florida — Number density plays a key role in influencing collective migration in cell layers, which exhibit a transition from fluid-like to solid-like motion as cells become increasingly packed. In confluent monolayers of MDCK cells, we observe multi-cellular patterns of alternating high-density and low-density regions. Since there is no free space in these layers, changes in cell density correspond to changes in projected cell area. With confocal microscopy we find that cell area fluctuations are approximately the same as cell volume fluctuations. Thus, multi-cellular density fluctuations in monolayers involve significant levels of fluid transport in and out of cells to accommodate their volume changes. To elucidate the relationship between density fluctuations and fluid transport we monitor cell layers in time-lapse, performing multiple simultaneous measurements. We study cell density dynamics by analyzing divergence in the migration velocity field. We also dye the cells with a cytosol dye incapable of traveling between cells, using dye dilution as a marker for fluid flow. We find that diverging/converging regions of cells contain about 15 cells and oscillate like 2D standing waves with a period of a few hours. We find that fluid waves propagate through the cell layer over multicellular length scales, accommodating these collective cell volume fluctuations.

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