Emergence of collective modes and tridimensional structures from epithelial confinement.

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Many \textit{in vivo} processes, including morphogenesis or tumor maturation, involve small populations of cells within a spatially restricted region. However, the basic mechanisms underlying the dynamics of confined cell assemblies remain largely to be deciphered. We will present our recent study of this question using well-controlled in vitro experiments \cite{1}. Our observations show that confluent epithelial cells cultured on finite, population-sized domains, exhibit both collective rotation with stochastic reversals and low-frequency radial displacement modes. A simple model in which cells are described as persistent random walkers which adapt their motion to that of their neighbors \cite{2}, appears to capture the essential characteristics of these collective dynamics. As the confined epithelia mature further, they develop a tridimensional structure in the form of a peripheral cell cord at the domain edge. In our well-controlled setting, epithelial confinement by itself is thus observed to induce morphogenetic-like processes including spontaneous collective pulsations and transition from 2D to 3D.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Left: Cells confined in a 150 μm domain. Center: Corresponding velocity field. Right: simulated velocity field from the theoretical model.}
\end{figure}
Figure 2: x-z profile at the edge of a domain several days after seeding. The pluricellular rim is globally polarized (red).


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