Tumor wave

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Understanding spatiotemporal dynamics of expanding biological tissues and their biophysical origins are essential in morphogenesis, wound healing, and tumor proliferation.
An increasing set of evidences suggests that many of the relevant phenomena originate from complex collective dynamics of the constituent cells that are physically active and inherently nonlinear, as in flocking animals or swirling molecular motor molecules. Here, using a thin disk layer of proliferating, cohesive, mono-clonal tumor cells, as a model system, we report the discovery of macroscopic, soliton-like, mechanical waves, slowly spanning the entire tissue domain in a periodic fashion. As the expansion of the tissue domain stalls and the cell density is further increased, the coherent waves break and yield to multiple swirling vortices that together exhibit an irratic spatiotemporal evolution. Although the exact mechanisms underpining the remarkable observations are still elusive, we find that some simple generic models proposed recently can recaputulate them. Our findings have established a new mode of tumor tissue expansion and it may be equally applicable for any expanding monolayer of cells under a suitable condition.