

Vorticity Patterns in Tissues induced by Cell Divisions

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In healthy blood vessels with a laminar blood flow, the endothelial cell division rate is low, only sufficient to replace apoptotic cells. The division rate significantly increases during embryonic development and under halted or turbulent flow. We study the long-range dynamics induced by cell division in an endothelial monolayer under non-flow conditions [1]. Cell divisions induce long-range, well-ordered vortex patterns extending several cell diameters away from the division site. We model these observations by a hydrodynamic continuum model simulating division as a local pressure increase in a non-nematic, meso-scale turbulent state [1]. In order to describe the injected energy by cell motion in the tissue we assume a negative local viscosity stabilized by a higher order term.

[1] N.S. Rossen, J.M. Tarp, J. Mathiesen, M.H. Jensen and L.B. Oddershede, Nature Communication 5, 5720 doi:10.1038/ncomms6720 (2014)