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Quantifying cell behaviors during embryonic wound healing[1]
DAVID MASHBURN, XIAOYAN MA, SARAH CREWS, HOLLEY LYNCH, W. TYLER MCCLEERY, M. SHANE HUTSON, Vanderbilt University — During embryogenesis, internal forces induce motions in cells leading to widespread motion in tissues. We previously developed laser hole-drilling as a consistent, repeatable way to probe such epithelial mechanics. The initial recoil (less than 30s) gives information about physical properties (elasticity, force) of cells surrounding the wound, but the long-term healing process (tens of minutes) shows how cells adjust their behavior in response to stimuli. To study this biofeedback in many cells through time, we developed tools to quantify statistics of individual cells. By combining watershed segmentation with a powerful and efficient user interaction system, we overcome problems that arise in any automatic segmentation from poor image quality. We analyzed cell area, perimeter, aspect ratio, and orientation relative to wound for a wide variety of laser cuts in dorsal closure. We quantified statistics for different regions as well, i.e. cells near to and distant from the wound. Regional differences give a distribution of wound-induced changes, whose spatial localization provides clues into the physical/chemical signals that modulate the wound healing response.

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