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Time markers for Drosophila morphogenesis based on cell-pattern topology. RICHARD ZALLEN, Department of Physics, Virginia Tech, JENNIFER A. ZALLEN, Developmental Biology Program, Sloan-Kettering Institute — Recent work on convergent extension in Drosophila has shown that the accumulation of actin-myosin networks at specific cell interfaces initiates planar polarity and the formation of multicellular rosette structures that contribute to elongation of the body axis [1]. This cell-rearrangement process takes place within a one-cell-thick layer, and the changing two-dimensional cell pattern can be characterized using topological measures such as cell-shape statistics [2]. We find that the timeline for the process contains a well-defined marker corresponding to a sharp increase in the slope of the time dependence of the variance of the cell-shape (number-of-sides) distribution. A rosette in this context is a cluster of cells enclosing high-order vertices at which 4 or 5 or more cells meet. While the cell-shape variance climbs steadily during axis elongation, the frequency of high-order vertices and large rosettes plateaus after 10 and 13 minutes, respectively. These time markers calibrate the conventional timeline descriptors referred to as stages 7 and 8 of embryonic development [3]. [1] J.T. Blankenship et al., Developmental Cell 11, 459 (2006); [2] J.A. Zallen and R. Zallen, J. Phys.: Condensed Matter 16, S5073 (2004); [3] J.A. Campos-Ortega and V. Hartenstein, The embryonic development of Drosophila melanogaster (1985).

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