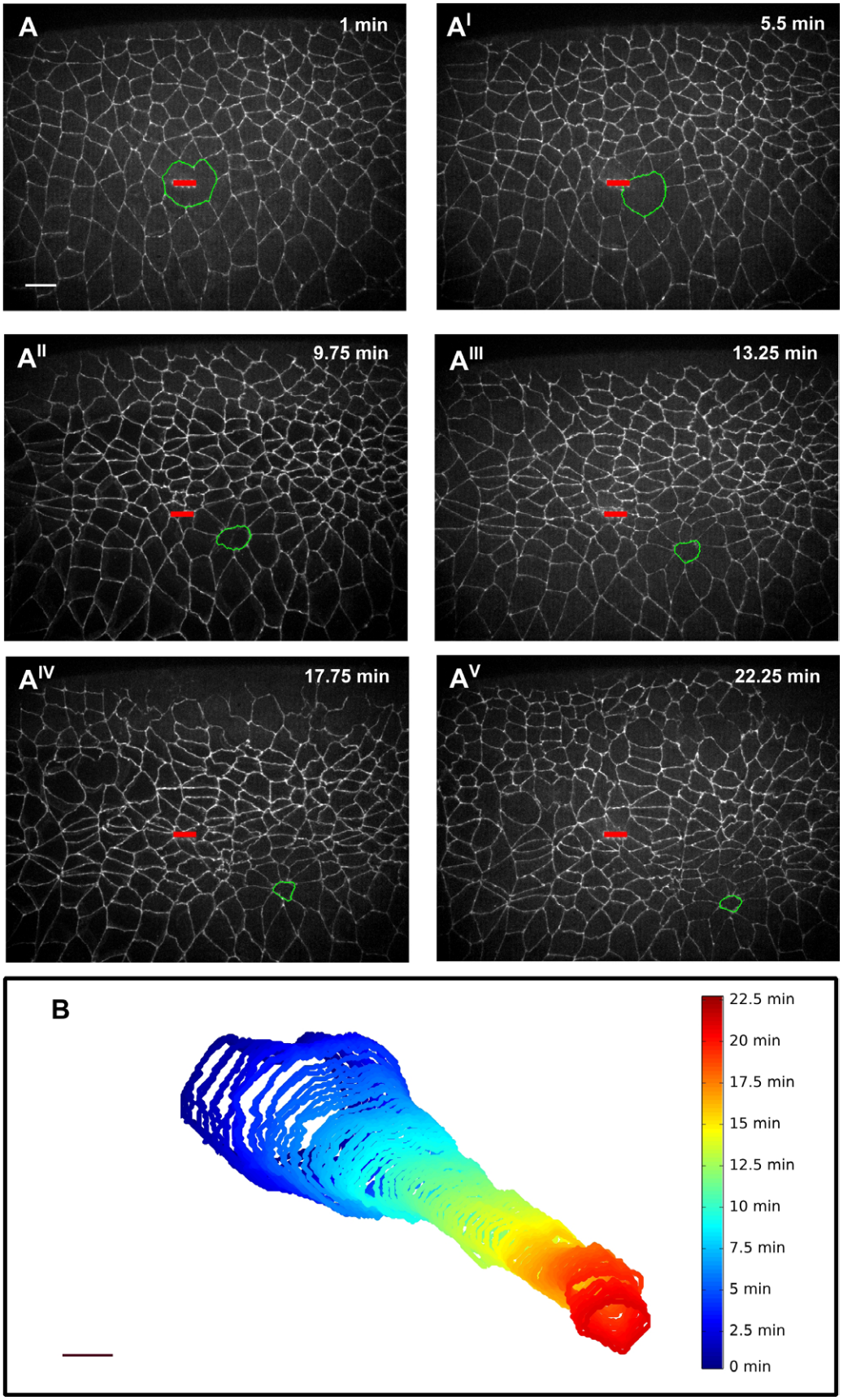


Figure S1. Optical flow to track cell movement. (A-A^{V}) Wound healing in the epidermis of a stage 7 *Drosophila* embryo expressing E-cadherin:GFP. The wound (green) changes shape and size as it moves away from the site of wounding (red). Scale bar, 10 µm. (B) Relative position of the wound at different time points. Scale bar, 5 µm. (A-B) Anterior left, dorsal up.

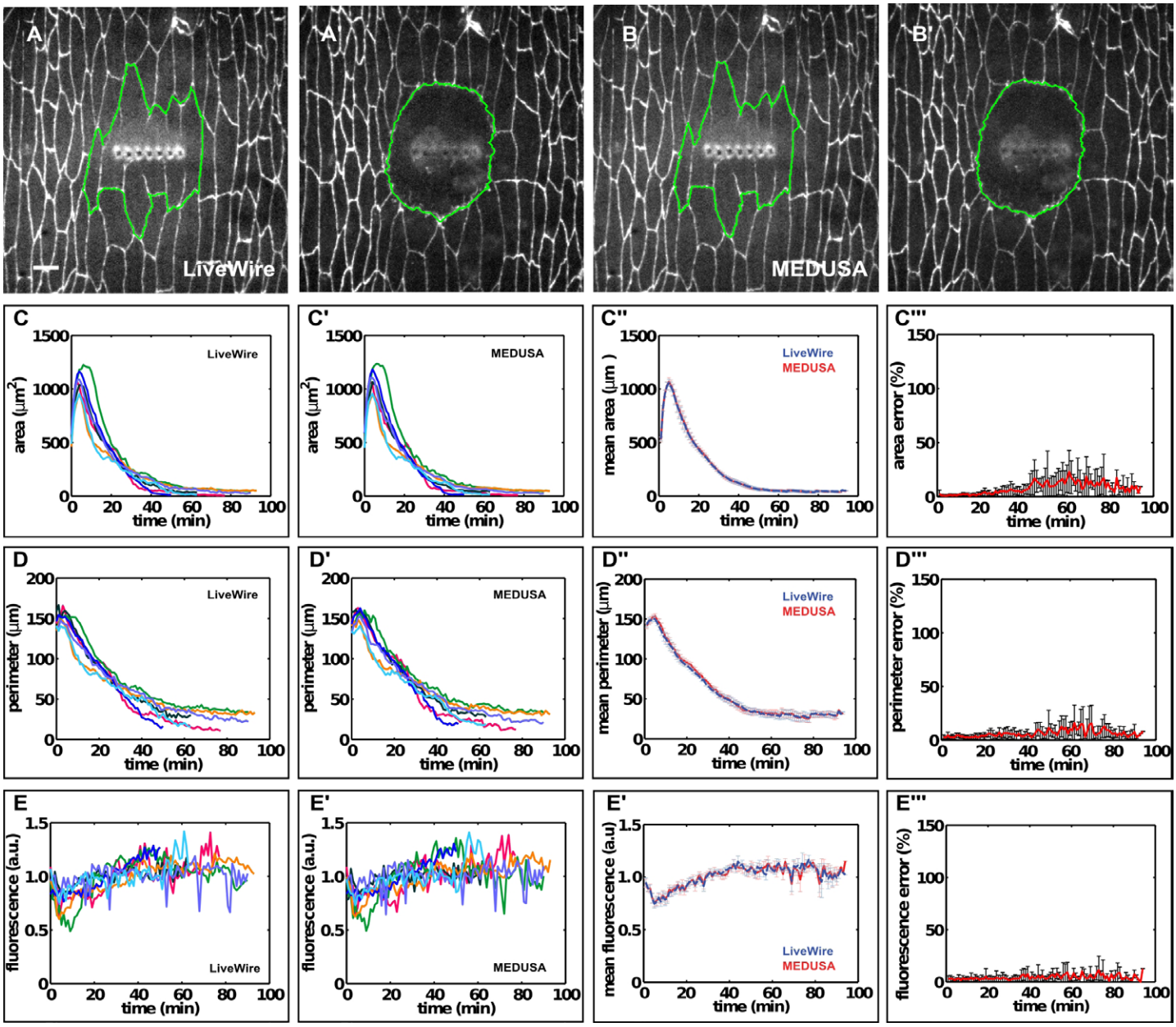


Figure S2. Validation of automated wound delineation using MEDUSA. (A-B) LiveWire (A-A') and automated (B-B') wound delineation in embryos expressing β-catenin:GFP. Scale bar, 5 μm. (C-E) Wound area (C-C'), wound perimeter (D-D') and fluorescence intensity at the wound margin (E-E') over time. Each line represents a different wound, lines with the same color represent the same wound (n = 7). (C''-E'') Average wound area (C''), perimeter (D'') and β-catenin:GFP fluorescence (E'') at the wound margin for LiveWire (blue) and MEDUSA (red) delineation. (C'''-E''') Average percent difference in wound area (C'''), perimeter (D''') and fluorescence (E''') of MEDUSA with respect to the LiveWire. Error bars, s.e.m.

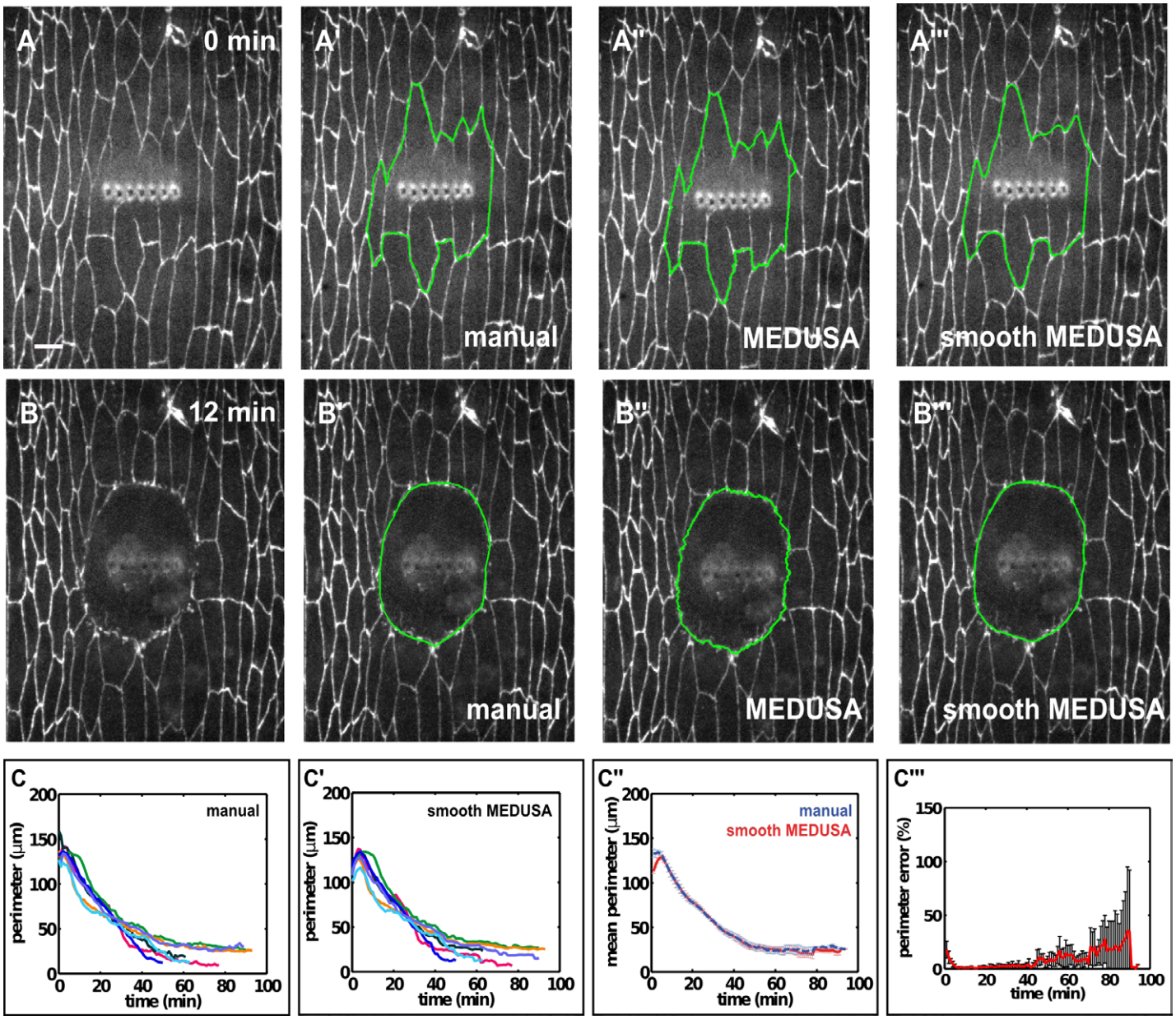


Figure S3. Wound perimeter measurements with manual and automated delineation differ due to the irregular contours generated by MEDUSA. (A-B) Wound delineation immediately after wounding (A) and 12 minutes later (B) in embryos expressing β-catenin:GFP. Wounds were delineated manually (A', B') or using MEDUSA (A'', B''), and the results from MEDUSA were smoothed (A'''-B'''). Scale bar 5 μm. (C) Wound perimeter over time measured manually (C) and with the smooth MEDUSA results (C'). Each line represents a different wound, lines with the same color represent the same wound (n = 7). (D) Average wound perimeter for manual delineation (blue) and smoothen MEDUSA. (E) Average percent difference in wound perimeter of smooth MEDUSA and manual measurements. Error bars, s.e.m.

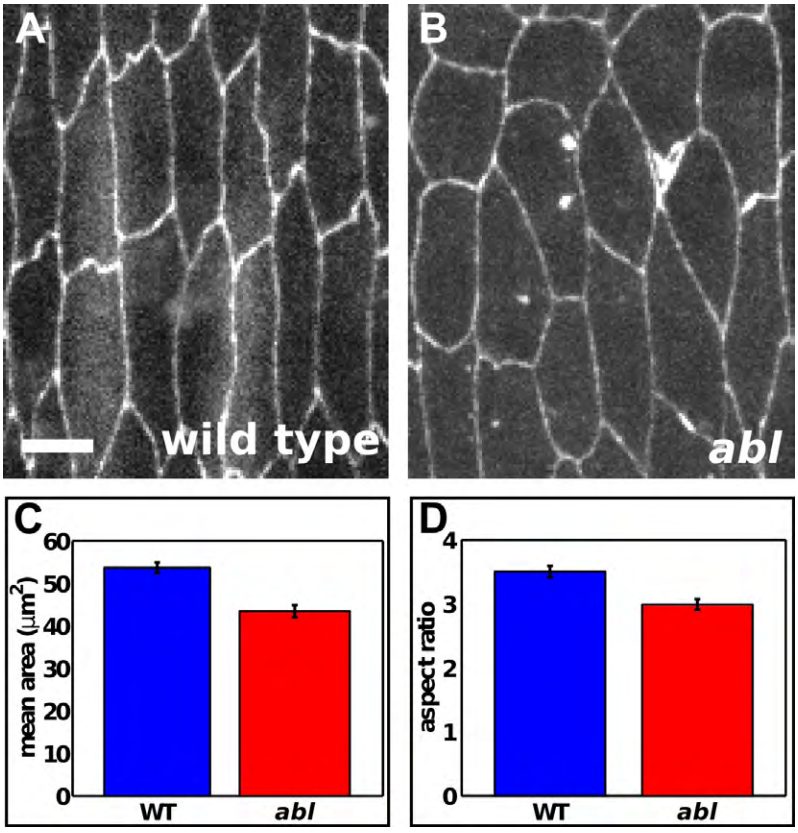


Figure S4. Abl regulates cell morphology in the embryonic epidermis (A-B) Cells in a wild-type embryo (A) and an *abl* mutant (B) expressing β-catenin:GFP. Scale bars, 5 μm. Anterior left, dorsal up. (C-D) Mean apical cell area (C) and aspect ratio (D) for wild-type embryos (blue, $n = 120$) and *abl* mutants (red, $n = 121$). Error bars, s.e.m.

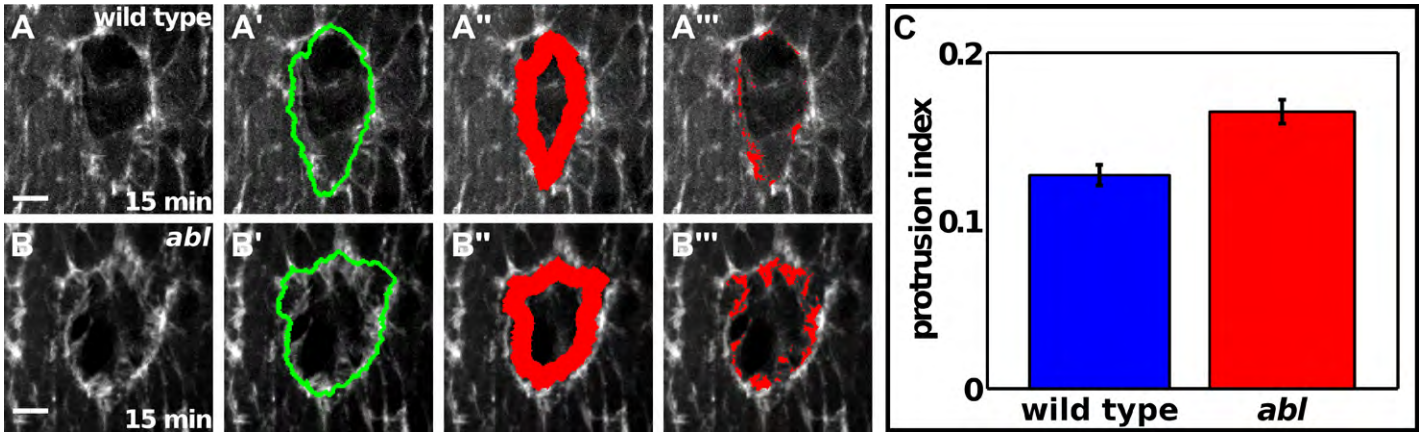
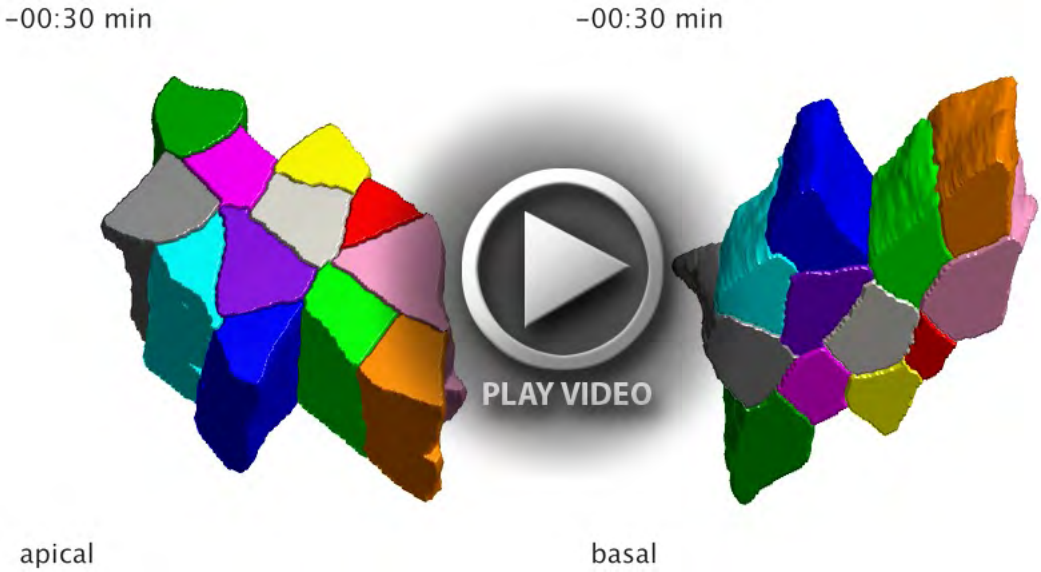
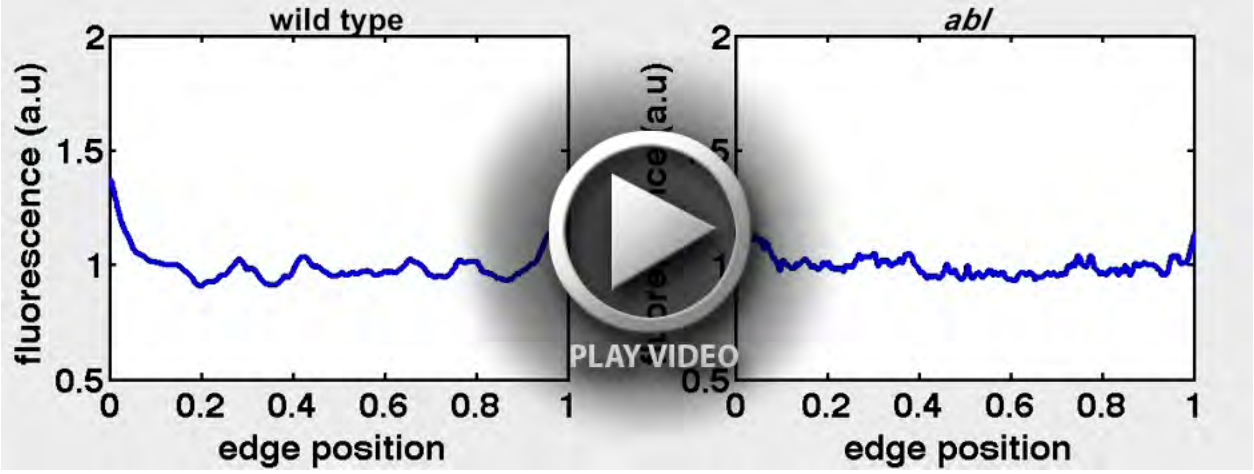


Figure S5. Increased protrusive activity in *abl* during embryonic wound repair. (A-B) Analysis of cell protrusions associated with wound repair in wild-type embryos (A-A''') and *abl* mutants (B-B''') expressing GFP:moesin. The wound was delineated using MEDUSA (A', B', green), and an annular mask was built inside the wound (A'', B'', red, see Materials and Methods). The fraction of pixels under the mask with values above the mean image intensity plus one and a half standard deviations was used to quantify protrusive activity (A''', B'''). Time after wounding is indicated. Scale bar, 5 μm. Anterior left, dorsal up. (C) Protrusion index for wild-type embryos (blue, $n = 26$ time points in 2 embryos) and *abl* mutants (red, $n = 65$ time points in 5 embryos). Error bars, s.e.m.



Movie 1. 4D cell shape changes in embryonic wound repair. 4D movie of cellular dynamics during wound closure from apical (left) and lateral (right) perspectives.

Movie 2. Abl accumulates at the wound margin. Epidermal cells expressing myosin:mCherry (left) and Abl:GFP (right). Time after wounding is indicated. Anterior left, dorsal up.



Movie 3. Defective β-catenin dynamics during wound repair in *abl* mutants. Graphs showing the mean β-catenin:GFP intensity profile along single cell edges at the wound margin for wild-type embryos (left) and *abl* mutants (right). Colors indicate time after wounding from 0 (dark blue) to 15 min (dark red)