Developmental roles for WDR1 in epidermal planar cell polarity

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Abstract

Planar cell polarity (PCP), the collective polarization of cells within a tissue plane is a hallmark of epithelial tissues. While the mechanisms that establish PCP are poorly understood it was recently shown that in the *Drosophila* wing disc cell shape dynamics affects the process. During the development of the mouse epidermis, core PCP proteins become polarized to orient the morphogenesis of hair follicles. Here, we identify a key role for WDR1, an F-actin binding protein that enhances cofilin/destrin-mediated F-actin disassembly. We show that the phenotype of *Wdr1*-depleted epidermis resembles a mutation in core PCP gene. The loss of either *cofilin* or *destrin* has no obvious phenotype in developing epidermis; however, their combined depletion disrupts cell adhesion and both apicobasal polarity and PCP. Seeking the nature of WDR1 selectivity, we find that epidermal cells change shape during PCP establishment, and that WDR1-mediated actin remodeling drives these dynamics. Moreover, we show that in the developing epidermis, cortical tension exists within the cells of the polarized layer, and that these internal forces are WDR1-dependent and essential for sculpting the accompanying cell shape changes that establish PCP in the mouse epidermis.