A feed-forward loop coupling extracellular BMP transport and morphogenesis in Drosophila wing

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A variety of extracellular factors regulate morphogenesis during development. However, coordination between extracellular signaling and dynamic morphogenesis is largely unexplored. We address the fundamental question by studying posterior crossvein (PCV) development in Drosophila as a model, in which long-range BMP transport from the longitudinal veins plays a critical role during the pupal stages. Here, we show that RhoGAP Crossveinless-C (Cv-C) is induced at the PCV primordial cells by BMP signaling and mediates PCV morphogenesis cell-autonomously by inactivating members of the Rho-type small GTPases. Intriguingly, we find that Cv-C is also required non-cell-autonomously for BMP transport into the PCV region, while a long-range BMP transport is guided toward ectopic wing vein regions by loss of the Rho-type small GTPases. We present evidence that low level of ß -integrin accumulation at the basal side of PCV epithelial cells regulated by Cv-C provides an optimal extracellular environment for guiding BMP transport. These data suggest that BMP transport and PCV morphogenesis are tightly coupled. Our study reveals a feed-forward mechanism that coordinates the spatial distribution of extracellular instructive cues and morphogenesis. The coupling mechanism may be widely utilized to achieve precise morphogenesis during development and homeostasis.
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