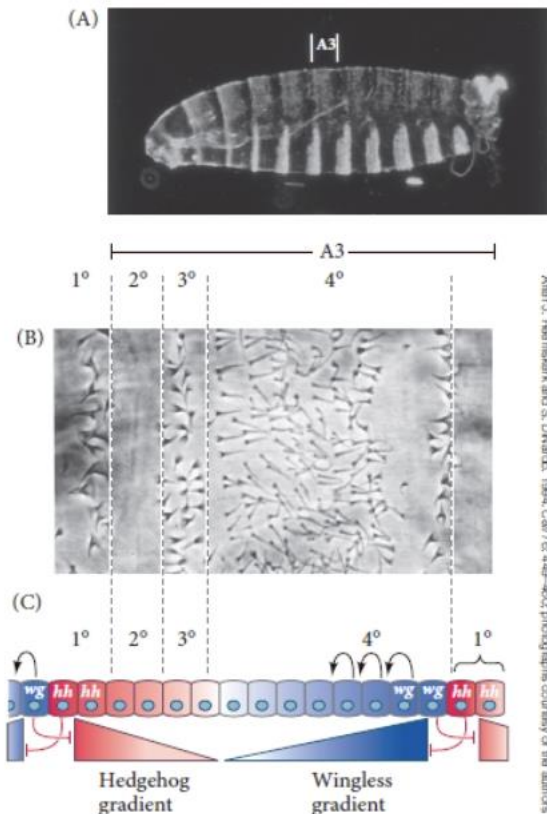


## FLYING “WINGLESS”: Discover cell specification by the Wingless/Hedgehog signaling center

In the cells transcribing the *wingless* gene, *wingless* mRNA is translocated by its 3' UTR to the apex of the cell (Simmonds et al. 2001; Wilkie and Davis 2001). At the apex, the *wingless* message is translated and secreted from the cell. The cells expressing *engrailed* can bind this protein because they contain Frizzled, which is the *Drosophila* membrane receptor protein for Wingless (Bhanot et al. 1996). Binding of Wingless to Frizzled activates the Wnt signal transduction pathway, resulting in the continued expression of *engrailed* (Siegfried et al. 1994). In this way, the transcription pattern of these two types of cells is stabilized. This interaction creates a stable boundary, as well as a signaling center from which Hedgehog and Wingless proteins diffuse across the parasegment. The diffusion of these proteins is thought to provide the gradients by which the cells of the parasegment acquire their identities. This process can be seen in the dorsal epidermis, where the rows of larval cells produce different cuticular structures depending on their position in the segment. The 1<sup>o</sup> row of cells consists of large, pigmented spikes called denticles. Posterior to these cells, the 2<sup>o</sup> row produces a smooth epidermal cuticle. The next two cell rows have a 3<sup>o</sup> fate, making small, thick hairs; they are followed by several rows of cells that adopt the 4<sup>o</sup> fate, producing fine hairs.



Cell specification by the Wingless/Hedgehog signaling center. (A) Dark-field photograph of wild-type *Drosophila* embryo, showing the position of the third abdominal segment. Anterior is to the left; the dorsal surface faces upward. (B) Close-up of the dorsal area of the A3 segment, showing the different cuticular structures made by the 1°, 2°, 3°, and 4° rows of cells. (C) A model for the roles of wingless and Hedgehog. Each signal is responsible for roughly half the pattern. Either each signal acts in a graded manner (shown here as gradients decreasing with distance from their respective sources) to specify the fates of cells at a distance from these sources, or each signal acts locally on the neighboring cells to initiate a cascade of inductions (shown here as sequential arrows). (After J. Heemskerk and S. DiNardo. 1994. *Cell* 76: 449-460.)

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