University of Southern California

Translational Imaging Center

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"Formation and interpretation of the Dorsal/NF-κB gradient"

The morphogen gradient is the prevalent model for spatial control of cellular differentiation in developing tissues. In this model, the concentration of a cell-to-cell signal (usually a protein) is graded in space, and the cells in the tissue respond in a concentration dependent fashion. In this way, a single signal, called a "morphogen", directs the differentiation of multiple domains of sub-tissue types.

As a model system, we study patterning networks in the early fruit fly embryo. This model system is extraordinarily tractable and amenable to live and fixed imaging, genetic manipulations, and transgenesis. Here we will discuss the formation and interpretation of the Dorsal/NF-κB gradient, which patterns the embryos' dorsal-ventral (DV) axis. Dorsal, a transcription factor, is retained in the cytoplasm through binding to the inhibitor, Cactus/IκB. Toll signaling on the ventral side of the embryo results in the degradation of Cactus (Cact) and the import of Dorsal into the nucleus. Recent measurements of the Dorsal (dl) gradient have shown that it is highly dynamic and too narrow to pattern the entire DV axis.

Our modeling work shows that dl/Cact complex in the nucleus contributes to some of the fluorescence measurements of the dl gradient, resulting in a difference between the presumed (measured) dl gradient and the true dl activity gradient. Subtracting the inactive dl/Cact complex from the dl fluorescence measurements results in a dl activity gradient with an extended dynamic range, which carries sufficient positional information to pattern the entire DV axis. Further model analysis on the dynamics of dl gradient formation shows that the dynamics are the result of slow accumulation of total dl on the ventral side of the embryo. We present experimental and modeling results that uncover the mechanism behind this overall accumulation.

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12:30 – 1:30 PM
RRI 101
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