中央大學物理學系

Department of Physics, National Central University

# Colloquium

# How Do Cells Decide Their Fates? Stochastic Patterning of Zebrafish Ionocytes as an Example


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**Venue: S4-625**

**Time: 14:00-16:00**


Abstract

Tissue patterning, the process by which progenitor cells differentiate into various functional cell types, is crucial for organ development. Notch signaling plays a key role in this process, particularly in the differentiation of different cell types. In zebrafish embryos, ionocytes—cells essential for ion regulation—are spatially dispersed across the skin, and their patterning is regulated by DeltaC-Notch signaling through lateral inhibition. Juxtacrine Notch-mediated lateral inhibition governs binary cell fate decisions, resulting in the characteristic salt-and-pepper pattern of cells. The final distribution of ionocyte subtypes appears randomly arranged on the embryonic skin, a feature typically assumed to be conferred by lateral inhibition alone. However, the temporal dynamics of this developmental process remain poorly understood, and it appears to be more complex than simple salt-and-pepper patterns. Furthermore, in vivo data have been limited. Our research investigates the spatiotemporal control of ionocyte progenitor specification during early zebrafish embryonic development. By using transgenic zebrafish lines expressing fluorescent reporters and time-lapse live imaging, we identified key phases of the DeltaC-Notch-mediated patterning process. Lateral inhibition begins at 8 hours post-fertilization (hpf), followed by progenitor cell division and the cessation of DeltaC expression by 12 hpf. Our findings reveal the dynamic role of DeltaC-Notch signaling in ionocyte progenitor specification and tissue patterning in vivo, providing insights into how the temporal dynamics of DeltaC-Notch signaling modulate the spatial patterning of ionocytes in zebrafish embryos.