CDB SEMINAR

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16:00~17:00 A7F Seminar Room

Divergent tissue dynamics of neural and non-neural ectoderm in the zebrafish

Summary

Geometric symmetries of the early embryo are broken as restricted domains within germ layers develop distinct cellular behaviours and mechanical properties. The differential tissue deformations resulting from the new heterogeneous distribution of forces mark the beginning of the large-scale tissue reshaping processes that form complex organs such as the brain from simpler sheet-like tissues. We recorded the initial morphogenetic divergence of adjacent anterior neural plate (ANP) and non neural ectoderm (NNE) in the zebrafish and provide a comprehensive, three-dimensional analysis of their local and global deformations, and evolving cell layer structure, during early forebrain neurulation. Tissue strains, and underlying cell deformation and intercalation rates, were mapped across the rapidly changing ectodermal sheet, revealing contrasting principal signatures of planar contraction and radial thickening in the ANP, and planar expansion and radial thinning in the NNE. These tissue-level changes reflect reciprocal programs of cell columnarisation in the ANP and flattening in the NNE, and relamination through radial de-intercalation in the ANP and radial intercalation in the NNE. Tissue dynamics in both the ANP and NNE are time-variant, anisotropic and spatially heterogeneous; we attribute this to mechanical interactions between the ANP, the bordering NNE, lateral midbrain tissue, and underlying prechordal plate mesoderm. These studies reveal a unique early neurulation mode in the ANP controlled by both active and passive tissue behaviour, identify the underlying single-cell and multicellular processes, and establish a quantitative framework for their analysis.

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