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# Epithelial dynamics during mouse neural tube development

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Spinal cord formation is achieved through dynamic changes of the cellular and tissue properties over time. In amniotes, its formation starts from a flat epithelial sheet which extends and folds at the embryo midline to form a closed neural tube. This morphogenetic transition involves changes in the epithelial organization as well as in the rates of cell proliferation and differentiation. However, how tissue growth is coupled to epithelial dynamics is unknown. Here, we investigate how the temporal dynamics of epithelial rearrangements in the neuroepithelium is controlled. To this end, we performed high resolution mosaic analysis at different developmental stages. We observed that clones of related cells are spatially fragmented when generated at early but not at late stages of development. This indicates that cell rearrangements occur frequently at early developmental stages and subsequently decline. To understand how cellular properties such as proliferation, differentiation and mechanical forces affect cell rearrangements, we are developing a computational vertex model of the mouse neural epithelium. To parameterize the model, we measured the cell shapes at different developmental stages. Interestingly, the model predicts that the rate of proliferation determines the degree of clonal fragmentation. We are currently designing assays that will allow us to test this prediction. Overall, the quantitative understanding of epithelial dynamics that we obtain in this study will provide insight into how cell rearrangements may affect pattern formation in the neural tube.

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