Neural Stem Cell Asymmetric Division in *Drosophila* Embryos

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Cell divisions that produce two non-identical daughter cells are defined as asymmetric. In all organisms, from yeast to mammal, asymmetric cell division plays a key role in generating cell type diversity during development. *Drosophila* embryonic central nervous system is a unique model to study the mechanisms of asymmetric cell division. During early neurogenesis, neural stem cells, neuroblasts, divide asymmetrically to produce two daughter cells with distinct cell sizes. The large apical cell remains as the stem cell and will continue to divide asymmetrically. The small basal cell is the ganglion mother cell which divides terminally to produce two neurons. Our previous work and others have shown that apical complex proteins are the major players that control three hallmarks of neuroblast asymmetric division: 1. basal localization of Pros, Numb and other cell fate determinants; 2. alignment of the mitotic spindle with the apical/basal axis and 3. formation of asymmetric spindle geometry, which is responsible for the daughter cell size difference. It is known that apical complex contains at least 6 proteins: Baz, Par6, DaPKC, Insc, Pins and Gαi, which can be functionally further subdivided into two pathways. Removal of any single component from the apical complex results in mislocalization of basal proteins and misorientation of the mitotic spindle early in mitosis. Geometry of asymmetric spindle is controlled by two redundant pathways within apical complex.

We believe that the knowledge of asymmetric cell division learnt from fruit flies can be applied to other stem cell studies.