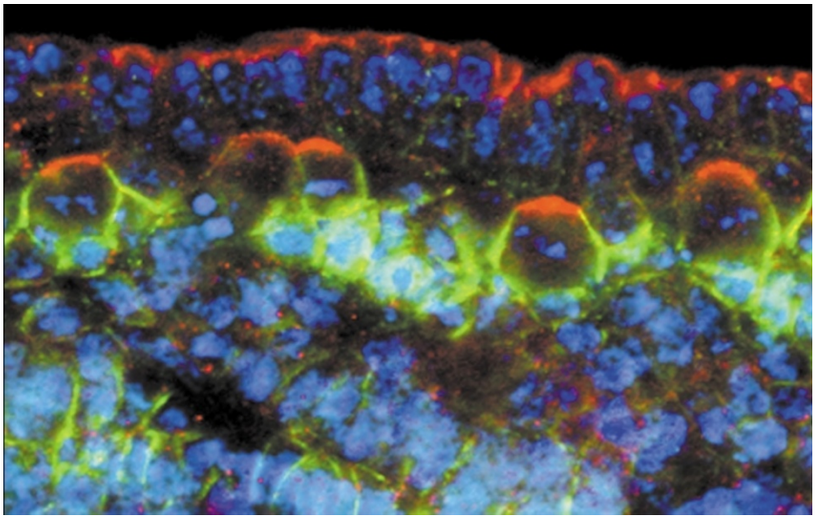
HIGHLIGHTS

CELL DIVISION

Not all are born equal

Contrary to the Marxist belief, not being equal can actually be a good thing. Asymmetric cell divisions generate diversity, and an avalanche of papers now shed some light on this process.

During asymmetric cell division, the precursor cell is polarized to segregate cell fate determinants predominantly into just one daughter cell, and the mitotic spindle is orientated along the appropriate axis before cytokinesis to ensure this. In the *Drosophila* central nervous system, neuroblasts divide asymmetrically along the apical–basal axis. Petronczki and Knoblich, and Wodarz *et al.* show that this process is similar to the first cell division in *Caenorhabditis elegans*. In neuroblasts the apical PDZ domain protein Bazooka is in a complex with DmPAR-6 (shown in red in the picture) and an atypical protein kinase C, and this complex controls apical–basal polarity, necessary for the correct basal localization of cell fate determinants (such as the Notch antagonist Numb and the transcription factor Prospero) and asymmetric cell division. Ohshiro *et al.* and Peng *et al.* show that the tumour-suppressor genes *lgl* (*lethal giant larvae*) and *dlg* (*discs large*) are also essential to position cell fate determinants at the basal cortex of neuroblasts, independently of the Bazooka complex. As for the position of the spindle, this is known to be controlled by the Bazooka complex and the apical protein Inscuteable with its partner Pins.



In the *Drosophila* peripheral nervous system, a series of asymmetric divisions generates the external sensory organ from a single precursor cell. Roegiers *et al.* and Bellaïche *et al.* find that, as the precursor pI cell divides, Numb and its partner PON localize to the anterior pole of the cell before the spindle rotates to position itself along the anterior–posterior axis. Numb localization and correct spindle orientation depend on *frizzled* and *flamingo*, two genes involved in planar polarity.

Roegiers *et al.* also show that division of the pIIb cell is similar to neuroblast division. They propose that this difference within the same lineage could arise because pIIb cells express Inscuteable, whereas pI cells do not. The Bazooka complex polarity cue (acting through Inscuteable) could be dominant over the Frizzled cue, leading to an apical–basal polarization. But in the absence of Inscuteable the spindle orientates along an anterior–posterior axis, which could be specified by Frizzled.

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References and links

ORIGINAL RESEARCH PAPERS Petronczki, M. & Knoblich, J. A. DmPAR-6 directs epithelial polarity and asymmetric cell division of neuroblasts in *Drosophila*. *Nature Cell Biol.* **3**, 43–49 (2001) | Bellaïche, Y. *et al*. *Frizzled* regulates the localization of cell-fate determinants and mitotic spindle rotation during asymmetric cell division. *Nature Cell Biol.* **3**, 50–57 (2001) | Roegiers, F. *et al*. Two types of asymmetric divisions in the *Drosophila* sensory organ precursor cell lineage. *Nature Cell Biol.* **3**, 58–67 (2001) | Ohshiro, T. *et al.* Role of cortical tumour-suppressor proteins in asymmetric division of *Drosophila* neuroblast. *Nature* **408**, 593–596 (2000) | Peng, C.-Y. *et al.* The tumour-suppressor genes *lgl* and *dlg* regulate basal protein targeting in *Drosophila* neuroblasts. *Nature* **408**, 596–600 (2000) | Wodarz, A. *et al. Drosophila* atypical protein kinase C associates with Bazooka and controls polarity of epithelia and neuroblasts. *J. Cell Biol.* **150**, 1361–1374 (2000)