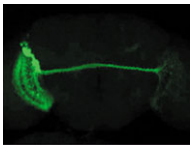
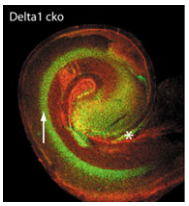


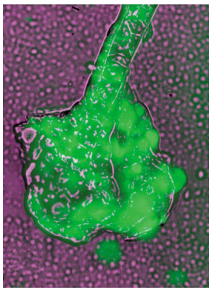
Polyhomeotic: a neuronal memory aid?

Cells 'remember' their identity by maintaining patterns of transcriptional repression that are established as they differentiate. The Polycomb-group (PcG) proteins are important players in this cellular memory system and their role in Hox gene regulation during embryogenesis has been extensively studied. Now, on p. 1231, Wang and co-workers report that the PcG protein Polyhomeotic (Ph) is required to maintain neuronal diversity during metamorphosis in the *Drosophila* brain and that other PcG proteins also function in neuronal development. The researchers used a genetic mosaic screen in adult fly brains to isolate a new *ph* mutation. In normal fly brains, different neuronal subtypes have characteristic projection patterns and gene expression profiles, but in the absence of *ph*, neurons acquire aberrant – but apparently uniform – morphologies and cellular identities. This transformation requires a pulse of ecdysone, leading the researchers to speculate that normal steroid hormone signalling (which drives metamorphosis) may have detrimental side effects on neuronal identity when PcG functions are compromised.



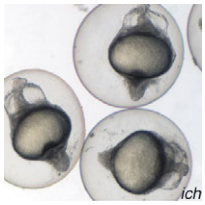
Hear hear: induction and inhibition Notched up

During development, Notch activation in one cell can inhibit its ability to make Notch ligands and so activate Notch in its neighbours. This 'lateral inhibition' produces mosaics of cells with different fates. However, sometimes Notch activation activates Notch ligand expression in the given cell, thereby driving neighbouring cells into a similar state (lateral induction). Now, Julian Lewis and colleagues report that, during mouse inner ear development, the Notch pathway first uses the Jagged1 (Jag1) ligand to induce prosensory patch formation – from which the sensory cells of the ear develop – and later uses Delta1 (Dll1) to control the formation of different sensory cell types through lateral inhibition (see p. 1277). They show that cochlear hair cells are produced early and in excess when *Dll1* is conditionally deleted in the mouse ear, indicating a failure of lateral inhibition. By contrast, conditional *Jag1* knockouts have a severe deficit of sensory tissue, indicating that prosensory cell induction has failed. These results provide new insights into inner ear development and the distinct developmental roles of different Notch ligands.



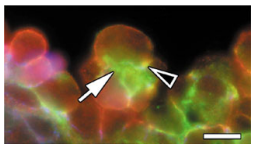
Signal changes for Dicty *Rb*

When starved, *Dictyostelium* amoebae differentiate into either spores or stalk cells. This decision partly depends on the cell-cycle status of a cell at the time of starvation. MacWilliams and co-workers now report that *rblA*, the *Dictyostelium* orthologue of the retinoblastoma susceptibility gene *Rb*, controls stalk/spore preference (see p. 1287). They show that, during growth, *rblA* expression correlates with factors that favour spore formation (late cell-cycle position, good nutrition) and that it increases 200-fold in differentiating spores. *rblA*-null strains show a strong preference for stalk formation when mixed with wild-type cells and are hypersensitive to the stalk morphogen DIF in vitro, indicating that *rblA* suppresses the DIF response in cells destined to be spores. However, *rblA* is not important for the *Dictyostelium* cell cycle. As *Rb* is required for both differentiation and cell-cycle exit in plants and animals, the researchers propose that *Dictyostelium* has retained the differentiation–*Rb* link but has lost the *Rb*–cell-cycle exit link to avoid shunting starving cells into the spore pathway.



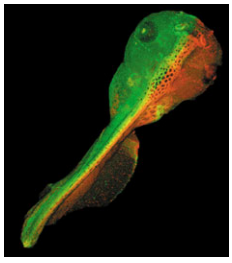
β-Catenin: it takes two

β-Catenin-mediated signalling is involved at several stages of vertebrate neural development. Early on, it is essential for the formation of the dorsal organiser, a neural-inducing and dorsalising signalling centre; later, it promotes posterior and ventral fates. On p. 1299, Bellipanni and colleagues use zebrafish to investigate the multiple roles of β-catenin in neural development. They identify a new β-catenin gene *(β-catenin-2*), the expression of which is reduced by the maternal-effect mutation *ichabod* – most embryos bred from females homozygous for this mutation lack notochord, head and trunk neurectoderm. Inhibiting β-catenin-2 function with morpholinos shows that it (but not the previously studied β-catenin-1) is needed for dorsal organizer formation. Later in development, however, the two β-catenins function redundantly to repress neurectoderm formation – in the absence of both functions, an abnormal tuft-like projection of neurectoderm forms with an apparently appropriate anteroposterior pattern. Overall, the researchers conclude that different β-catenins can have different, sometimes opposing, roles at different times during neural development.



Knockout insights into mammalian PAR3

Epithelial cysts – cavities formed from monolayers of polarised epithelial cells – serve as progenitors for many mammalian organs. However, what controls cyst formation is poorly understood. Hirose et al. now report that the polarity protein PAR3 is required for the formation of epicardial progenitor (EPP) cell cysts in mice (see p. 1389). During mammalian heart development, cysts made from EPP cells migrate to the myocardium and envelop it in a layer of epicardial cells. The researchers show that targeted disruption of the mouse *Par3* gene causes midgestational embryonic lethality with defective epicardial development. They report that PAR3-deficient EPP cells form normal cell-cell junctions and basal domains but do not establish apical cortical domains or form cell cysts. Because cell–cell and cell–extracellular matrix interactions (which occur through basal domains) provide the spatial cues for epithelial cell polarity, these results suggest that PAR3 normally interprets these cues and, importantly, they provide the first evidence for the involvement of PAR3 in epithelial polarity and tissue organisation during mammalian development.



At the heart of asymmetry

The vertebrate body plan is far from symmetrical, both in terms of left-right (LR) organ asymmetries and LR positioning of the heart and viscera. These asymmetries originate early in development when the LR axis of the embryo is established. Errors in this process cause laterality disorders, many of which include congenital heart defects. On p. 1399, Ramsdell and co-workers investigate how LR positional information is translated into anatomical asymmetry by determining the left or right origin of the myocytes in the developing *Xenopus* heart. They fluorescently labelled left and right blastomeres of four-cell embryos and tracked where they went in the hearts of normal embryos and embryos in which LR patterning had been disrupted. Their detailed analysis reveals that whenever the LR body axis is compromised, the LR cell lineage composition of the heart is abnormal. Such defects are almost always associated with congenital heart defects, which indicates that the proper allocation of LR cell lineages to the heart is central to normal heart morphogenesis.

Jane Bradbury