the induction of cytoprotective autophagy in response to apoptotic stimuli, because only a small fraction of Atg5 is required for formation of the autophagosome to occur[13].

These new findings are conceptually important as they demonstrate that Atg-dependent cell death is not necessarily associated with autophagosome formation. It will be interesting to determine whether the function of Atg proteins (other than Atg12 and Atg8 ubiquitin-like attachment systems) can also be modulated by posttranslational modifications. □

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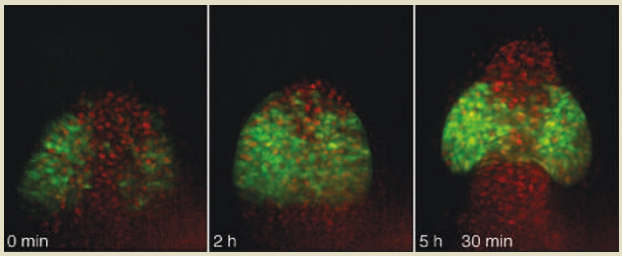
How wandering cells make a perfect eye

Formation of the vertebrate optical lobe is a model system for studying organogenesis. The cellular mechanisms leading to the emergence of the optical lobe are unknown. Rembold *et al.* have now shown that migration of single retinal progenitors is essential for growth of the optical lobes (*Science* **313**, 1130–1134; 2006).

To follow retinal progenitors at the time of neural tube formation, Rembold *et al.* used medaka fish embryos expressing a fluorescently tagged version of the retinal-specific transcription factor Rx3. They observed that the most medially and ventrally localized retinal progenitors only exhibit short range movements, thus defining a wide domain at the site of future eye emergence. However, neural cells and laterally localized retinal progenitors converge more actively to the middle of the embryo. Once there, the neuronal progenitors elongate the neural tube, whereas the lateral retinal cells join the most stable retinal progenitors population. All retinal cells then move outwards to form one optical lobe on each side of the future head. By visualizing the membranes of the migrating retinal cells in the embryo, the researchers found that similarly to single migrating cells, lamellipodia and filopodia form at their front and they are also able to move over their neighbours.

To understand whether this behaviour was biologically important, the researchers examined *rx3* mutants, which lack eyes despite having retinal progenitors. In *rx3* mutant embryos, all retinal progenitors behave like neural cells, such that they only move towards the middle of the embryo and are integrated in the neural tube, leading to eyeless animals. Thus, both the movements of retinal progenitors to form a wide domain, as well as their migration outwards from the neural ridge, are necessary for optical lobe formation. When wild-type retinal progenitors are transplanted in an *rx3* eyeless mutant embryo, they have the same migratory properties as those of a wild-type animal and are able to form an optical lobe. *rx3* expression is therefore necessary and sufficient to specify the migratory characteristics of the retinal progenitors and the directional cues for migration are still intact in an *rx3* mutant embryo.



During eye formation, evaginating Rx3 positive cells (green) define a wide domain and then emerge on each side of the embryo (nuclei; red).

Although demonstrating that cell autonomous migration of retinal progenitors is essential for eye formation, these findings also raise new questions. For example, why do medial and lateral retinal progenitors exhibit different patterns of movement and what causes cells to change direction and migratory characteristics at a given time during development? Future *in vivo* studies of migration dynamics during development will be critical for resolving these intriguing problems.

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