DEVELOPMENT

Cell patterning by preferential adhesion

A new study shows how dynamic interactions between two cell-adhesion molecules, Roughest and Hibris, determine the precise patterning of the developing *Drosophila* eye.

Cell–cell adhesion is essential for morphogenesis, the process by which single cells are shaped and assembled into complex tissues and organs. But it is not clear how the multitude of cell surface molecules involved in cell adhesion influences cell fates and tissue patterning.

Bao and Cagan looked at adhesion processes in *Drosophila* eye development. At late larval stages, the eye disc, a monolayer epithelium, differentiates to form an array of 'unit eyes' or 'ommatidia', each of which contains photoreceptor cells, lens-secreting cone cells and primary pigment cells. Undifferentiated cells between these ommatidia, the interommatidial precursor cells (IPCs), then undergo morphogenetic movements and differentiate to create a hexagonal lattice of secondary and tertiary pigment cells and mechanosensory bristles.

Two proteins that are required for this process are Roughest and Hibris, mutations of which lead to abnormally patterned eyes and defects in the axons that project from the eye to the brain. Bao and Cagan show that these proteins are expressed by complementary cells types, and that Hibris serves as a Roughest-binding protein. IPCs expressing Roughest are attracted to Hibris-expressing primary pigment cells, and because Roughest binds more strongly to Hibris than to itself, IPCs compete for contact with ommatidia, which leads to a progressive reduction in IPC–IPC contacts. IPCs that lose out in the competition for contact with ommatidia — those with lower levels of Roughest — eventually die, whereas those expressing high levels of Roughest form long-lasting junctions with primary pigment cells. The authors argue that as successful IPCs maximize their contact with ommatidia, they form a shape with the lowest possible surface free energy — a hexagon.

So, preferential adhesion mediated by heterophilic cell-adhesion molecules seems to be the driving force behind the elaborate patterning of the *Drosophila* eye. It will be interesting to learn whether preferential adhesion can explain pattern formation in other tissues and organs.

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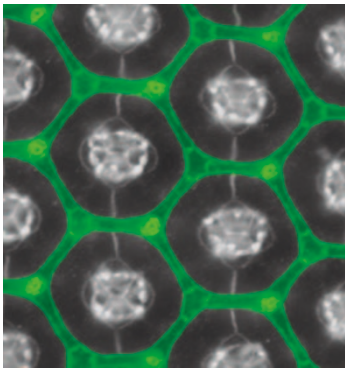

Interommatidial cells (artificially coloured green) form a hexagonal pattern around ommatidia in the *Drosophila* pupal eye. Image courtesy of S. Bao and R. Cagan, Washington University in St Louis, Missouri, USA.

References and links

ORIGINAL RESEARCH PAPER Bao, S. & Cagan, R. Preferential adhesion mediated by Hibris and Roughest regulates morphogenesis and patterning in the *Drosophila* eye. *Dev. Cell* **8**, 925–935 (2005)

FURTHER READING Hayashi, T. & Carthew, R. Surface mechanics mediate pattern formation in the developing retina. *Nature* **431**, 647–652 (2004)

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