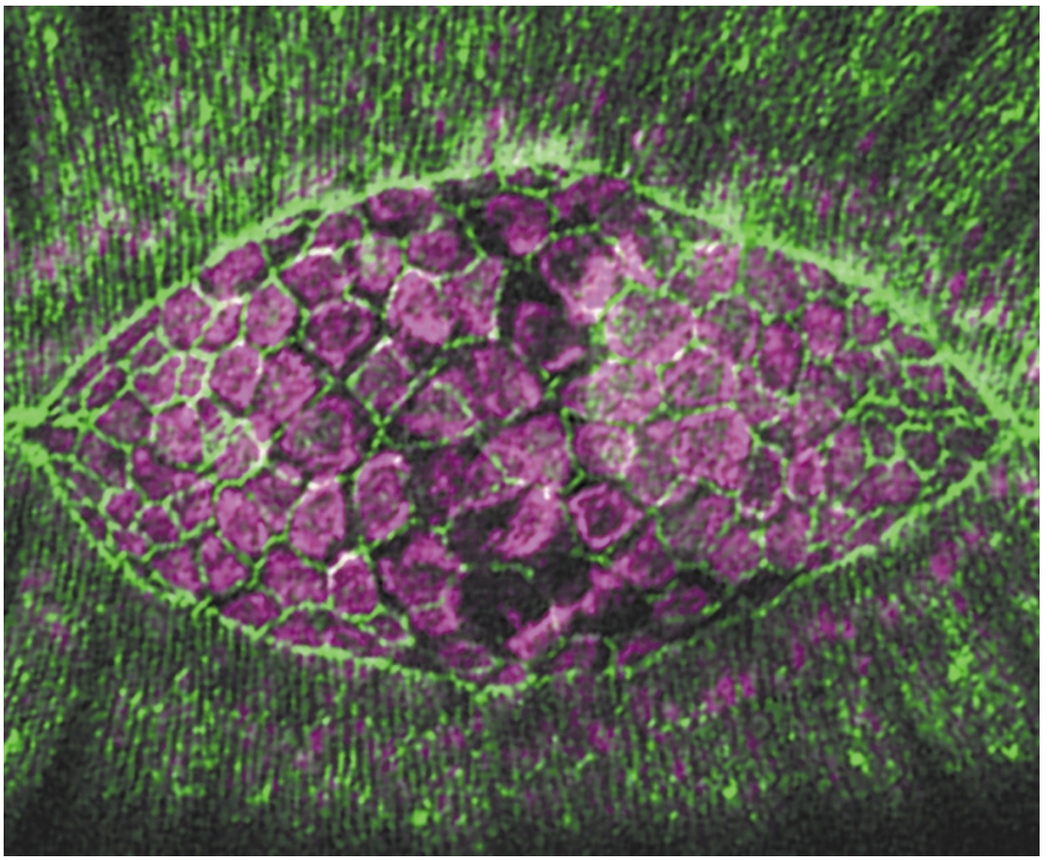

View of the amnioserosa and lateral epidermis of a *Drosophila melanogaster* embryo undergoing dorsal closure, immunostained to visualize phosphotyrosine (green) and DFos (pink). DFos is cytoplasmically localized in amnioserosal cells at this stage. (Image courtesy of Bruce Reed, University of Toronto.)

DEVELOPMENT

Edging forward

Jun amino-terminal kinase (JNK) is known to operate during dorsal closure, a process whereby two sheets of epidermal cells on either side of the extraembryonic amnioserosa stretch over and displace the amnioserosa, resulting in the zipper-like closure of the dorsal surface. Activation of JNK in the leading-edge cells of the epidermis induces secretion of decapentaplegic (Dpp), which causes lateral epidermal cells to elongate dorsoventrally. But Howard Lipshitz and colleagues now show that, while JNK activity remains high in the leading edge, dorsal closure also requires that JNK signalling is downregulated in the amnioserosa. The presence of this high/low JNK activity boundary probably underlies the formation of focal complexes — areas of the cell in which proteins transduce extracellular signals to influence the actin cytoskeleton — in the leading edge of the closing epidermis, thereby influencing cell shape and behaviour.

The authors showed that hindsight (Hnt), a zinc-finger transcription factor, is needed for dorsal closure using *hnt* mutants that expressed reduced levels of Hnt protein — most of the mutant embryos showed an 'anterior-open' or 'dorsal-hole' phenotype. Further analysis showed that JNK signalling was upregulated in the *hnt* mutants, suggesting that Hnt might downregulate JNK activity during dorsal closure. Hnt is expressed in the amnioserosa, but not in the epidermis, and the authors used *lacZ*-enhancer-trap lines that expressed Dpp and Puckered (Puc) — two downstream substrates of JNK — to confirm that JNK signalling is downregulated at, or before, the start of dorsal closure.

As a further measure of JNK activity, the authors looked at the cellular localization of the AP-1 transcription factors DJun and DFos in the amnioserosa. Before dorsal closure, both proteins localize to the nucleus but, during dorsal closure, DFos is predominantly cytoplasmic and DJun is present in both the cytoplasm and the nucleus (possibly as a consequence of its longer half-life). Predictably, DJun and DFos both persisted in the nuclei in the *hnt* mutants.

What effect does downregulating JNK activity have on dorsal closure? Persistent JNK signalling in the amnioserosa (as occurs in *hnt* mutants) prevents the accumulation of phosphotyrosine and F-actin — components of focal complexes — in the leading-edge cells.

A simple interpretation of this is that focal complexes cannot form unless there is a high/low JNK signalling boundary between the leading edge and the amnioserosa. As focal complexes comprise many proteins that can effect the dynamics of the actin cytoskeleton, it is likely that such structures mediate the ability of the epidermis to move dorsally before fusing at the dorsal midline.

Katrin Bussell

References and links

ORIGINAL RESEARCH PAPER Reed, B. H. *et al*. Downregulation of Jun kinase signaling in the amnioserosa is essential for dorsal closure of the *Drosophila* embryo. *Curr. Biol.* **11**, 1098–1108 (2001)
FURTHER READING Jacinto, A. *et al.* Mechanisms of epithelial fusion and repair. *Nature Cell Biol.* **3**, E117–E123 (2001)
WEB SITE Lipshitz laboratory

WEB WATCH

All about actin

It's always worth checking institutional sites to see what your peers are doing. For anyone with an interest in actin research, one to look at is the cell biology and cytoskeleton group of the Division of Hematology at Harvard Medical School, which boasts several acknowledged leaders in actin research, including Tom Stossel and John Hartwig. The site is essentially a departmental page, with information about staff contact details and seminar dates but will no doubt still interest the outside scientist for several reasons.

The most interesting section will probably be the 'research overview' page. Covering topics such as actin crosslinking, cytoskeletal polymer physics and the genetics of motility, this gives not only a brief overview of the department's current projects but also gives an informative and colourful review of each subject. Some of these contain movies, which may take a while to download but allow the viewer to see some fascinating images, like a crawling neutrophil 'chasing' a bacterium. In this section, there is also an in-depth review on the biochemistry and biophysics of actin filaments.

Another section of interest is the 'protocols' page, which covers a wide range of tried and tested methods from 'the very basics' (such as precipitation of proteins) to more complex procedures used in biochemistry and cell biology research of the cytoskeleton. And with several direct links to the WWW Virtual Library of Cell Biology, the viewer has easy access to more basic tutorials, DNA and protein databases, and links to suppliers of scientific equipment and reagents, thus providing a handy resource for the cell biologist.

Simon Frantz