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DEVELOPMENT

Dancing the polonaise

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Researchers have answered a long-standing question in developmental biology by revealing the driving forces of the massive cell movements that occur during early embryonic development.

Gastrulation is a crucial stage in embryonic development, during which extensive cell migration causes a single cell layer (ectoderm) to generate two others (endoderm and mesoderm), which then form various cell and tissue types. One of the earliest signs of gastrulation in reptiles, birds and mammals (amniotes) is the appearance of a thickening at the midline of the developing embryo, the primitive streak. Here, ectoderm cells converge and ingress to form the new cell layers. Extensive cell movements resembling the polonaise dance precede the formation of the primitive streak.

A group led by Claudio Stern now provide the first multi-photon time-lapse microscopy analysis of individual cell movements in living chick embryos. The authors labelled ectoderm cells and filmed them shortly after the 'polonaise' movements started. The high-resolution three-dimensional images revealed a previously undiscovered event of cell intercalation, which occurs precisely where the primitive streak will form later in embryonic development.

Cell intercalation movements occur during and after gastrulation of amphibian and teleost fish (anamniotes) and depend on the activity of the Wnt planar cell polarity (Wnt-PCP) signalling pathway. Stern and colleagues found that Wnt-PCP genes are expressed in an area of the chick embryo similar to that undergoing intercalation, and they therefore suggested that Wnt-PCP genes could govern this cell movement in amniotes too. To verify this hypothesis, the authors used two different methods to block the activity of the Wnt-PCP signalling pathway in the intercalation region of the chick embryo and showed that intercalation and primitive streak formation were inhibited.

What are the molecular mechanisms underlying the precise expression of Wnt-PCP genes and the position of the site of intercalation? To address this question, the authors tested whether factors known to be secreted by the hypoblast, a cell layer unique to amniotes, direct the expression of Wnt-PCP signalling pathway components in the embryo. They found that only fibroblast growth factor-8 (FGF8) induced the expression of these genes in the intercalation region of the developing embryo.

The authors therefore propose that, compared to anamniotes, the chick (and possibly all amniotes) evolved an additional intercalation event that occurs in the ectoderm and precedes gastrulation.

Francesca Cesari

ORIGINAL RESEARCH PAPER Voiculescu, O. *et al.* The amniote primitive streak is defined by epithelial cell intercalation before gastrulation. *Nature* **449**, 1049–1052 (2007)
FURTHER READING Tam, P. P. & Loebel, D. A. Gene function in mouse embryogenesis: get set for gastrulation. *Nature Rev. Genet.* **8**, 368–381 (2007) | Stern, C.D. *Gastrulation: from Cells to Embryo* (Cold Spring Harbor Laboratory Press, New York, 2004)
WEB SITE
Claudio Stern's laboratory:
http://sternlab.anat.ucl.ac.uk