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[Biology] Academia Sinica's Researchers Discover Molecular Mechanisms of Left-right Asymmetric Control in the Sea Urchin

[Biology] Academia Sinica's Researchers Discover Molecular Mechanisms of Left-right Asymmetric Control in the Sea Urchin (Chinese Version)

Academia Sinica Newsletter (2012/11/05) Researchers at the Institute of Cellular and Organismic Biology ( ICOB ), Academia Sinica recently uncovered the molecular mechanisms that control the left-right asymmetry that leads to the five-fold radially symmetric body plan in sea urchins. The discovery adds evolutionary depth to the origin of the mechanisms, which were previously found only in vertebrates. The study was published online in PLOS Biology on October 9, 2012.

The study demonstrates that a protein named bone morphogenic protein (BMP) controls the left-sided development in the sea urchin. On the right-side, a protein called Nodal blocks the BMP signaling and induces cell death. This left-right asymmetric control results in the formation of an adult rudiment on the left side and it later develops into a five-fold symmetric sea urchin.

In bilaterally symmetric animals, the external appearance of their left side represents a mirror image of the right side. However, the internal organs are often left-right asymmetric. Two signals, Nodal and BMP, have been shown to influence the left and right side, respectively, to establish this asymmetry during vertebrate embryogenesis. The study investigated whether the same mechanisms that establish left-right patterning in vertebrates are conserved in invertebrate animals.

Sea urchins are marine invertebrates and have been used for developmental studies for over a century. In recent years, due to the establishment of microinjection techniques and the sequencing of the sea urchin genome, sea urchin has become one of the model organisms for studying developmental gene regulatory networks. Previous studies have shown that right-sided Nodal signaling in sea urchins prevents the formation of the adult rudiment. In this study, Dr. Yi-Hsien SU’s group shows that BMP signaling is required for the development of this left-sided structure. The right-sided Nodal signaling and left-sided BMP activity establish left-right asymmetry in the sea urchin. The study is important to understand how a bilateral symmetric embryo transforms into a left-right asymmetric larva. More importantly, the results are foundations for further studies on the developmental origins of the peculiar five-fold symmetric body plan in sea urchins.

Related Website:
http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1001402.

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