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Old genes, new tricks

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Cephalopods (octopus, squid, and their kin) are a diverse group of molluscs that exhibit a range of novel characteristics not found in other molluscs. Their shell is usually much reduced or absent, their mantle is co-opted for respiration and locomotion, and the muscular molluscan foot is modified into prehensile arms and a funnel. The group is also characterized by a complex central nervous system and well developed eyes. In the September 4 Nature, Patricia N. Lee and colleagues at the University of Hawaii at Manoareport that *Hox* genes - which specify the body plan of most multicellular animals and are among the most highly conserved of genetic sequences - have been recruited "multiple times and in many ways" in the origin of the morphological novelties of the Cephalopoda (*Nature* 2003, **424:**1061-1065).

Lee *et al.* used whole-mount in situ hybridization to map, for the first time in a cephalopod, the expression of *Hox* genes in embryos of the Hawaiian bobtail squid *Euprymna scolopes*. Eight of the nine *Hox* genes were expressed in a number of the morphological novelties found only in cephalopods. An important characteristic of *Hox* genes is their collinear pattern of expression - their sequence on a chromosome reflects where they are expressed along an animal's anteroposterior axis. While such colinearity holds in the basal gastropod mollusc *Haliotis asinina*, it breaks down in the squid, suggesting that conventional *Hox* gene expression has been modified by regulator genes.

"Our expression data indicate that *Hox* genes can potentially be co-opted to function in diverse developmental contexts, not all of which are related to patterning the anteroposterior axis," write the authors. "Our data suggest... that the morphological plasticity that is so striking in this group... may be due to relaxation of regulatory constraints on the recruitment of various regulatory genes involved in morphological patterning of bilateral animals," they conclude.

References

1. *Nature*, [http://www.nature.com]

2. University of Hawaii at Manoa, [http://www.hawaii.edu/welcome/manoa.html]

3. The spatial and temporal expression of *Ch-en*, the *engrailed* gene in the polychaete *Chaetopterus*, does not support a role in body axis segmentation.