

'Orphan' genes play an important role in evolution

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Closely related animal species share most of their genes and look almost identical. However, minor morphological differences allow us to tell them apart. What is the genetic basis for these differences? Often, the explanation is provided by minor changes in spatial and temporal activity of transcription factors - "regulator" genes which are conserved throughout the animal kingdom. However, every group of animals also possesses a small proportion of genes which are, in contrary, extremely variable among closely related species or even unique.

For example, a gene may be present in one species or animal group, but not in any other. Such genes are referred to as "novel," "orphan" or "taxonomically restricted". Their function and origin are often obscure. What are these genes needed for?

A new paper, published in this week's issue of the online open access journal, *PLoS Biology*, explores this question in the freshwater polyp Hydra, which belongs to the same branch of the evolutionary tree as jelly fish. These animals are small (several mm long), predatory creatures, with a tube like body-form that ends in a mouth surrounded by mobile tentacles. They are of particular interest to scientists for their regenerative properties, and because they appear to be biologically immortal; not undergoing the aging process that affects all other known animals.

In this paper, a team of scientists from the Christian-Albrechts-Universität zu Kiel in Germany, used transgenic polyps to uncover the



role of "orphan" genes in these morphologically-simple animals. The work, led by Thomas Bosch reports that a family of "novel" genes is responsible for morphological differences between two closely related species of fresh water polyps called Hydra. Their most remarkable finding is that a secreted protein, encoded by "novel" gene Hym301, controls the pattern in which the tentacles in Hydra develop.

"We knew that these genes were important, but it was in no sense simple to demonstrate that," says Konstantin Khalturin, first author of the PLoS Biology paper.

In one species, Hydra oligactis, emergence of its tentacles during bud formation is not synchronised; in Hydra vulgaris all five tentacles develop simultaneously and symmetrically; in Hydra vulgaris polyps genetically altered to produce large amounts of protein from the 'orphan gene' Hym301, tentacles are formed in an irregular and asymmetric pattern.

The data indicate that "novel" genes are involved in generation of novel morphological features that characterise different species, thus pointing the way to a new, more complete understanding of how evolution works at the level of a particular group of animals. Emergence of "novel" genes may reflect evolutionary processes which allow animals to adapt in the best way to changing environmental conditions and new habitats.

Citation: Khalturin K, Anton-Erxleben F, Sassmann S, Wittlieb J, Hemmrich G, et al. (2008) A novel gene family controls species-specific morphological traits in Hydra. PLoS Biol6 (11): e278. doi:10.1371/journal.pbio.0060278 biology.plosjournals.org/perls ... journal.pbio.0060278

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