How to structure a complex body plan

Phenotypic flexibility enables multicellular organisms to adjust morphologies to variable environmental challenges. Such plastic variations are also documented in reef corals. Coral colonies are made of multiple genetically identical physiologically integrated modules (polyps).

Like other sedentary colonial marine organisms, corals may generate extremely broad structures, changing their morphologies by growing new polyps above existing structures. In branching forms, two higher levels of organization exist, the ‘branch’ and the ‘colony’. Despite the relative morphological simplicity of each module, branching corals can generate complex architectures at the colony level of organization.

In a study published in the July 25 issue of the online, open-access journal PLoS ONE, a group of scientists led by Dr. Rinkevich from the National Institute of Oceanography, Haifa, and Tel Aviv University, Israel, elucidated fixed and plastic architectural rules for colony formation in a common branching coral (Stylophora pistillata) from Eilat, the Red Sea, which develops spherical colonies.

The scientists examined 16 morphometric parameters on 136 one-year old colonies, all developed from different types of isolated branches, and found that the plastic morphometric characters are associated with the branch level whereas the fixed, predetermined morphometric traits are associated to the colony level.

In addition, the group found that, depending on the original branch structure, the spherical 3-D colonial architecture in this species is achieved by joining developmental processes at both, the branch and the colony levels of organization. In nature, branching colonial forms are often subjected to harsh environmental conditions that break the colony into fragments of different size and structure. Plastic developmental rules that are not predetermined and react to fragment structure allow the formation of species-specific architecture through variable developmental routes. This adaptive plasticity, or regeneration, is an efficient mechanism by which isolated fragments of branching coral species cope with external environmental forces.

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