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A Phylogenetic Study of the Anthozoa (Phylum Cnidaria) Based on Morphological and Molecular Characters

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The Anthozoa is a well-defined class, with several unique features distinct from other cnidarians, and is divided into 15 orders in three subclasses, but the evolutionary relationships of subclasses and orders within the Anthozoa have long remained equivocal. Wells and Hill (1956) proposed three subclasses in the Anthozoa based on the arrangement of mesenteries: subclass Ceriantipatharia, which branches off first, and then the two remaining subclasses, Alcyonaria and Zoantharia. Schmidt (1974) later divided the Anthozoa into two subclasses: Alcyonaria and Zoantharia, based mainly on the composition of nematocysts. Insubclass Zoantharia, he suggested that the order Ceriantharia, which was placed in subclass Ceriantipatharia together with order Antipatharia by Wells and Hill (1956), is the most primitive, and Antipatharia has a common ancestor with the order Zoanthinaria. Evolutionary studies of the class Anthozoa using molecular systematics have been applied to some taxa of Zoantharia (McCommas, 1991: Fautin and Lowenstein, 1992; Garthwaite et al., 1994; Romano and Palumbi, 1996; Veron et al., 1996). Molecular systematics provides an added measure to establish the interrelationship among anthozoans and to resolve the difficulties of morphological classification of anthozoans. In this study, the phylogenetic relationships within the Anthozoa were re-evaluated based on 41morphological characters and nuclear sequences of 18S ribosomal DNA (29 anthozoans as ingroups and 3 hydrozoans as outgroups). The parsimony trees derived from the morphological data did not coincide closely with the molecular data, and the presence of several polytomies at some nodes of the trees resulted in ambiguities among the systematic relationships. On the other hand, the combined analysis using total evidence presents a more resolved and highly supported topology, as in indicated by higher bootstrap values and decay indices than either analysis alone. However, strict and semi-strict consensus trees derived from taxonomic congruence show a poorer resolution for the phylogeny of Anthozoa. The trees constructed from the molecular dara, using neighbor-joining and maximum-likelihood methods, are nearly congruent with the result from the total evidence. Based on these results, Anthozoa is divided into three subclasses: Alcyonaria, Zoantharia, and Ceriantipatharia. The Ceriantipatharia now includes only oneorder, Ceriantharia, since the order Antipatharia is more closely related to orders within the Zoantharia. The Alcyonaria is a monophyletic group, in which the order Pennatulacea is basal, and orders Alcyonacea and Telestacea branch later. The order Gorgonacea is divided into two suborders, Holaxonia and Scleraxonia. *Bellonela*is more related to order Stolonifera, forming a monophyletic group. In Zoantharia, the order Zoanthinaria is basal and remaining taxa are divided into two clades: one includes the order Actiniaria and the other includes orders Antipatharia, Corallimorpharia, and Scleractinia. The latter two orders form a monophyletic group. This study presents a different phylogeny of actiniarians from the earlier hypothesis of scleractinian ancestry.