

THE GREAT ESCAPE FROM PARASITISM

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Parasitism has been referred to as an “evolutionary dead end”, because the transition to parasitism is unidirectional. Once an organism becomes an obligate parasite, it is likely to remain an obligate parasite due to the loss of metabolic pathways. *Nephromyces* is a genus in the parasitic phylum Apicomplexa, but has an apparent mutualistic relationship with *Molgula* tunicates. Support for a mutualistic relationship is based largely on a nearly 100% host infection rate with no known clearance of *Nephromyces*. Because transition away from obligate parasite is so rare, little is known about the evolutionary steps involved in such a transition - particularly in a lineages with such a long history of obligate parasitism as Apicomplexa. In order to examine this unusual evolutionary transition, we sequenced transcriptomes from *Nephromyces* and its parasitic sister taxon, *Cardiosporidium ciona*, which is an excellent model for what *Nephromyces* might have looked like as a parasite. Both *C. ciona* and *Nephromyces* have tunicate hosts and bacterial endosymbionts, but each maintains a different lifestyle. A comparison of *Nephromyces*, *C. ciona*, and their endosymbionts will be presented with a focus on system dynamics, relationships, and clues to how this transition occurred.