OR281

Evolving eusociality: The effects of manipulation, relatedness and genetic diversity.

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Cooperative sociality has two potential advantages over a solitary life history: (1) Opportunities to ally with close genetic kin and reap inclusive fitness benefits from aiding them; and (2) The ability to create social heterosis through synergistic cooperation across genetically diverse individuals with complimentary skill sets. To maximize one of these benefits, however, requires limiting or losing the other benefit. Both cannot be simultaneously increased. The benefits of high relatedness have often been invoked as being almost a prerequisite for the evolution of cooperative breeding and sterile morphological castes (i.e., the monogamy hypothesis). However, theoretical models on the evolution of these traits have produced mixed results, with some models predicting that monogamy is neutral or can even retard the spread of cooperation in populations. Furthermore, recent data from a facultatively social bee strongly suggest that mothers manipulate daughters into helper roles, rather than daughters maximizing their inclusive fitness from working. If maternal manipulation is responsible for creating the initial stages of a eusocial society, then matedness levels become irrelevant from the standpoint of maternal inclusive fitness (i.e., the threshold for cooperation from Hamilton's Rule, $r > c/b$, is fixed at 0.5). In this presentation I will do two things. (1) Resolve why the alternative models differ in their predictions on the advantages (or lack thereof) from monogamy and haplodiploidy vis-a -vis multiple mating and diplodiploidy. (2) Incorporate the advantages of genetic diversity in a model for the evolution of cooperation that directly tackles the trade-off of kin-directed nepotism versus social heterosis. The latter follows from the realization that r, b and c need not be independent variables. With social heterosis, as relatedness decreases, benefits can increase or costs decrease.