

1 Cooperation and competition in pathogenic bacteria.

Griffin AS, West SA, Buckling A

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Hamilton's theory of kin selection explained numerous aspects of the evolution and maintenance of cooperative, altruistic behaviour. Here, the authors confirm and extend these observations by finding a strong correlation between relatedness and the scale of competition in pathogenic bacteria.

However, advantages of cooperation will vary not only as a consequence of relatedness, but also as a function of the spatial scale of competition for limiting resources -- because stronger competition among relatives may reduce advantages of cooperation.

This study uses a pathogenic bacterium to independently manipulate relatedness and spatial scale of competition in a factorial fashion to determine how these parameters interact to affect the proportion of competitors and cheaters. The authors show not only increased cooperation with increased relatedness, but also that increased local competition also selects decreased cooperation and that there is a significant interaction between relatedness and the scale of competition, with relatedness having less effect when the scale of competition is more local.

Disclosures

None declared

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Abstract:

ABSTRACT

Explaining altruistic cooperation is one of the greatest challenges for evolutionary biology. One solution to this problem is if costly cooperative behaviours are directed towards relatives. This idea of kin selection has been hugely influential and applied widely from microorganisms to vertebrates. However, a problem arises if there is local competition for resources, because this leads to competition between relatives, reducing selection for cooperation. Here we use an experimental evolution approach to test the effect of the scale of competition, and how it interacts with relatedness. The cooperative trait that we examine is the production of siderophores, iron-scavenging agents, in the pathogenic bacterium *Pseudomonas aeruginosa*. As expected, our results show that higher levels of cooperative siderophore production evolve in the higher relatedness treatments. However, our results also show that more local competition selects for lower levels of siderophore production and that there is a significant interaction between relatedness and the scale of competition, with relatedness having less effect when the scale of competition is more local. More generally, the scale of competition is likely to be of particular importance for the evolution of cooperation in microorganisms, and also the virulence of pathogenic microorganisms, because cooperative traits such as siderophore production have an important role in determining virulence.

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