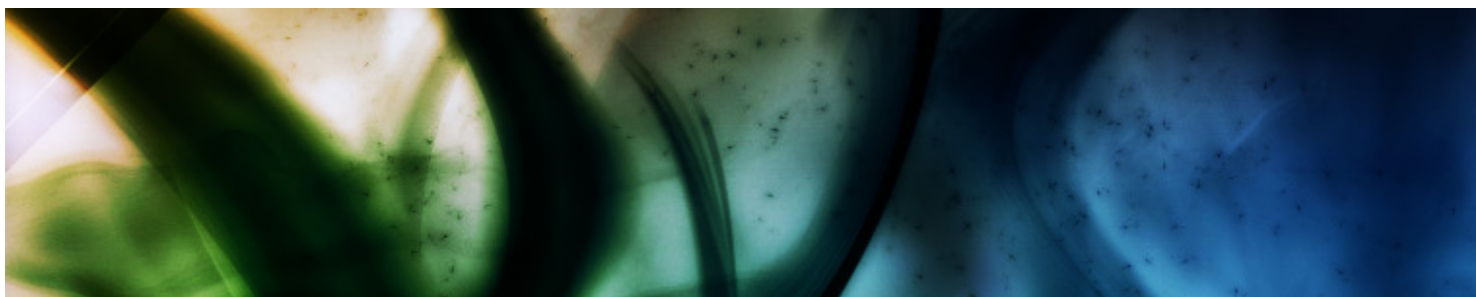


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[Kin Selection and the Evolution of Virulence](#)

[Kin Selection and the Evolution of Virulence](#)

-*Heredity*, Buckling and Brockhurst, 2008

Microbes possess many different methods of communication that can result in socially directed cooperative efforts toward a common goal or malicious efforts with the purpose of reducing the fitness of another species.

Social Traits

Cooperation – the most common form of bacterial social behavior and comes in two forms, (1) Prudence, where individuals limit their resource use for the benefit of others and (2) Public goods production, where individuals donate resources that are of benefit to others.

Spite - costly to both the actor and recipient. Given fitness costs, spiteful can only be explained by kin selection. Spite can be favoured when the recipient has a lower relatedness to the actor than the population as a whole, and when these ‘negatively related’ individuals can be specifically targeted by the spiteful action. The actor then indirectly benefits from the spiteful behavior by reducing competition experienced by the actor’s relatives.

Kin selection – the process that maximizes inclusive fitness (Maynard-Smith, 1964). For kin selection to favor cooperation, the degree of genetic relatedness of interacting individuals must be high relative to the population as a whole.

This article specifically focuses on experimental data that address how kin-selected cooperation and spite affect virulence. How relatedness, through its effect on cooperative and spiteful traits, is predicted to affect virulence depends on the type of social behavior displayed by parasites, including prudence, public goods cooperation and spite.

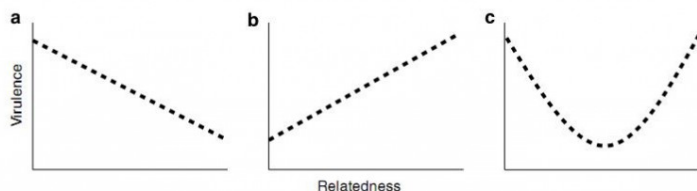


Figure 1 Hypothesized relationships between virulence and relatedness under conditions of prudence (a), public goods cooperation (b) and spiteful interactions (c).

Conclusions

Prudence - If prudent use of host resources (a form of cooperation) maximizes the transmission success of the parasite population, decreased relatedness is predicted to result in increased host exploitation and virulence.

Public Goods Cooperation – If parasite within-host growth rate is a positive function of cooperation (that is, when individuals need to donate public goods, such as extracellular enzymes), virulence is predicted to increase with increasing relatedness.

Spite – There is some evidence supporting theory that suggests that spiteful behaviors are maximized at intermediate degrees of relatedness, which, in turn, leads to minimal virulence because of the reduced growth rate of the infecting population.

Another Example.....

[Bacteriocins, spite and virulence \(PDF\)](#)

A classic result of virulence theory is that intensity of exploitation and hence damage to hosts correlates negatively with kinship among the organisms infecting a host. This occurs because a lower relatedness leads to greater competition for resources, which selects for faster growth rates to obtain a greater quantity of the host resources, and these higher growth rates lead to higher virulence.

Just as altruistic behavior can promote parasite growth and hence enhance virulence, it is reasonable to assume that spiteful interactions (mutual antagonism) between parasites could reduce the vigor of an infection and associated host damage.

A good example of this is bacteriocin production. Bacteriocins are the most abundant of a range of antimicrobial compounds produced by bacteria, and are found in all major bacterial families. They are a diverse family of proteins with a range of antimicrobial killing properties, including enzyme inhibition, nuclease activity and pore formation in cell membranes. Unlike other antimicrobials, the lethal activity of bacteriocins is often limited to members of the same species as the producer.

Clone mates are protected from the toxic effects of bacteriocins by genetic linkage between the bacteriocin gene and an immunity gene that encodes a factor that deactivates the bacteriocin.

Gardner, A., West, S. A., and Buckling, A. 2004. Bacteriocins, spite and virulence. *The Royal Society*. 271: 1529-1535.

~ by ian on April 13, 2010 .

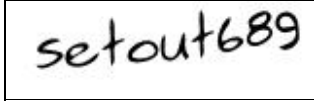
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