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News

The nail in the coffin for group selection?

Benefits to an individual and its family may be enough to account for altruistic behaviour.

Brendan Maher

A model that examines the behaviour of parasites infecting their hosts renders the evolutionary paradigm of group selection unnecessary, say scientists in Canada and the United Kingdom¹.

Why organisms display behaviours or other adaptations that aren't directly beneficial to them is a question that has intrigued biologists and caused conflict between different schools of thought for generations. Bees that spend their lives serving their queen, for example, and elephants that care for the offspring of others in the herd are participating in cooperative acts that may undermine their own chances of reproducing.



Altruistic behaviour is tricky to explain.

Getty

Group selection, generally pinned to the writings of British zoologist Vero Wynne-Edwards in the 1960s, provided a framework for understanding the balance between altruistic and self-interested adaptations, proposing that group-level adaptations for group-level survival were possible. Voiced more recently by others including David Sloan Wilson, an evolutionary biologist and author at the State University of New York at Binghamton, group theory has come to mean selection and adaptation at multiple levels: traits can confer benefits to the individual, the family, the group or the society.

But an alternative explanation — kin selection — based on the fitness of the individual and the benefits conferred to an individual's closest kin has held sway for a majority of evolutionary biologists over the years.

Infectious idea

Kin selection, first expressed mathematically by British evolutionary biologist William Hamilton at about the same time as Wynne-Edwards, looks at an organism's inclusive fitness — which includes the number of its own offspring but also the relatedness of individuals that the organism helps. Its proponents have come to regard the gene as the ultimate unit of adaptation.

In a paper published online today in *Nature*¹, Geoff Wild, a mathematician at the University of Western Ontario in London, Canada, and his co-authors expand on a common model — that of parasites infecting a population of hosts.

"Inclusive fitness is the thing," says Wild. "It's a powerful way to think about the world and a powerful way to model the world."

Parasites are prone to increase their reproduction rates and correspondingly their virulence, which can prove fatal for hosts, and so leave the parasites stranded. But if parasites reduce their reproduction rates, limiting their use of resources, they can spread from host to host, reaching greater numbers.

"Inclusive fitness is the thing."

Geoff Wild
University of Western

Ontario

The authors modelled this virulence versus avirulence balance across three tiers: in the individual host, within a group of hosts, and on an island with many groups of hosts. "The new thing we'd done was to take an explicit kin-selection approach to that model," says Wild. Importantly, he says, it measures the different kinds of reproductive success a given parasite can enjoy, including opportunities for future spread.

One and the same?

The paper claims that all predictions about population adaptation can be made without invoking group-level adaptations and that individual fitness can account for everything they see. Indeed, both frameworks generate the same predictions. But for Wild, group selection is not a robust way of modelling the real world: "The paranoid scientist in me wonders whether you shouldn't use the tool that's always going to work."

However, Wilson says any claim that the research renders group-selection theory obsolete is "frankly deceptive". Rather than displace group theory, he says, the article has simply described it in a different way, and one that is not new to the language of group selection. "Does this count as an example of group-level adaptation? Judged by the way these concepts were defined through the history of the subject, the answer would be yes."

The model the authors use assumes that each individual host can be infected by only one strain of parasite at a time. Among other issues he has with the paper, Wilson calls this a devastating shortcoming. By not allowing different parasites to battle it out for supremacy in a given host, it overlooks a fitness measure at a crucial spot. "If they're going to talk about the evolution of virulence, they're going to have to talk about evolution in a single host."

But Wild says that such tinkering would do little to improve the model. "Within host competition? It would be great," he says. "But what I don't see is that one would have to do that to get across the message of adaptation that we're trying to."

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References

1. Wild, G. , Gardner, A. & West, S. A . *Nature* advance online publication [doi:10.1038/nature08071](https://doi.org/10.1038/nature08071) (2009).

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