# For the benefit of society? No, for the good of my family

28 May 2009

**The idea of truly selfless behaviour as a driving force of evolution has suffered another blow.**

A new parasite-host model shows that what was thought to be behaviour to benefit the community can actually be interpreted as an adaptation to promote individual and family survival.

Parasites need to harm their hosts to survive and multiply. But how nasty can they get without running out of fresh victims to infect? Each individual parasite aims to produce as much new offspring as possible to maximise the survival of its genes. However, if all parasites behave with such high virulence, the number of available hosts decreases and the parasite population stalls.

So parasites adapt their rate of reproduction to balance the maximum number of offspring against the damage to the hosts - it is well known that parasites are less dangerous to hosts if dispersal is limited. The evolution of this self-shading strategy to avoid overexploitation of resources is often cited as an example of group selection: producing less offspring benefits the group, not the individual that sacrifices reproduction success.

Although individual selection does not explain this scenario, Dr Geoff Wild from the University of Western Ontario and colleagues from the University of Edinburgh were not so convinced by group selection either. They decided to look at something in between - the selection of adaptations that benefit the individual and its closest relatives.

The team created a computer model recreates the transmission of a common infectious agent in a population of healthy hosts. Wild and his colleagues introduced a 'mutant' parasite to the formulation to allow genetic variation into the model. 'Without variation, selection cannot operate,' he says. Following the mutant and its descendents for long enough, the model also tells the fate of a single family group within the parasite population. 'This way, we were able to analyse what happens at the individual, family and population levels,' Wild explains.

In the model, both parasites and hosts were allowed to migrate between different patches. Wild used the degree of dispersal as a 'lever to change the parasite's world and see how the balance between virulence and reproductive success adapts to this change.'

Results published this week in *Nature* show that indeed parasite dispersal rates affect the degree of virulence: if migration rates are low, parasites become less dangerous. This harbours important individual benefits. If the offspring cannot migrate and colonise more hosts, there is no long term advantage to produce as many descendants as possible because the offspring become stranded in an overexploited host population. Limiting virulence and number of offspring also reduces competition to individual parasites and within the family group.

Lower virulence can be selected for reasons beneficial to individuals and close relatives. In particular, lower virulence leaves relatives a legacy of comparative prosperity: more opportunities to create future infections and promote long-term success. 'There is no need to invoke altruistic group selection,' says Wild.

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G. Wild, A. Gardner and S. West. 2009. Adaptation and the evolution of parasite virulence in a connected world. *Nature* (published online 27 May 2009) doi:10.1038/nature08071

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